



2003
Forest
Science
in
the South

United States
Department of
Agriculture
Forest Service



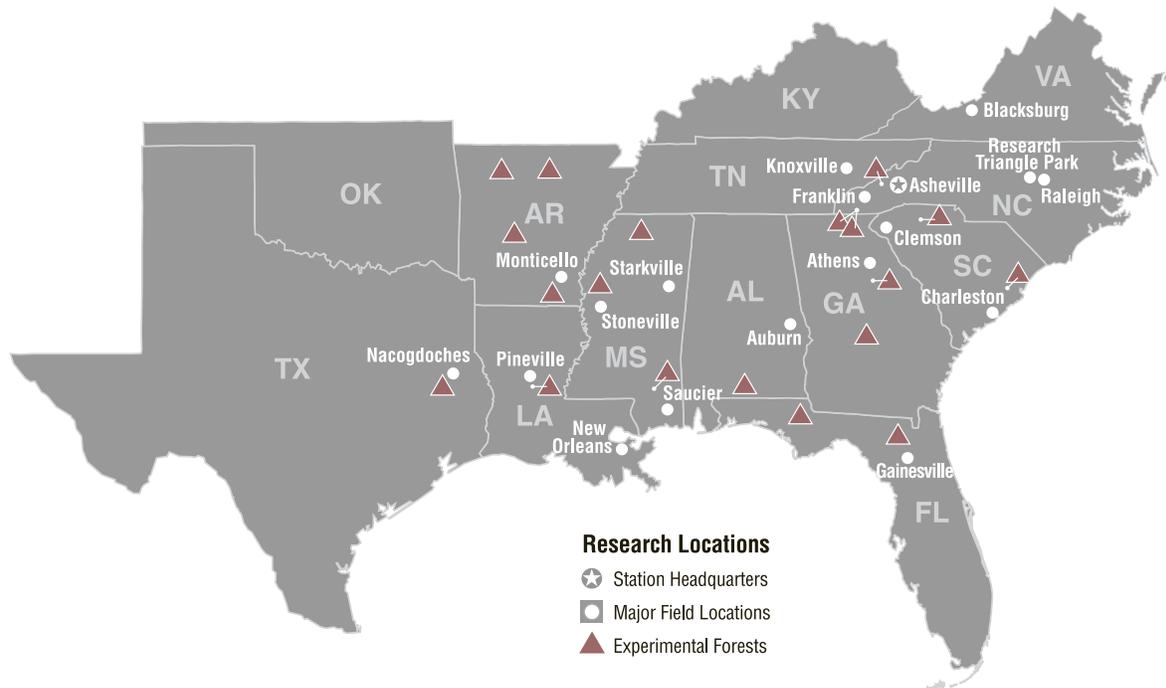
Southern
Research Station

Science Update
SRS-005



Southern Research Station

Our mission is to create the science and technology needed to sustain and enhance southern forest ecosystems and the benefits they provide.



Cover: Rafinesque's big-eared bat in flight, an endangered species in South Carolina, photo by J. MacGregor; Florida scrub jay on the Ocala National Forest, an endangered species in Florida, photo by B. Lea; Rhododendron leaf, photo by Zoë Hoyle; southern magnolia (*Magnolia grandiflora*) flower, photo by B. Lea; western North Carolina mountain biker Curt Atkinson crosses a log obstacle on the Pisgah National Forest, photo by Timm Muth.

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here have been registered. All uses of pesticides must be registered by appropriate State and/or Federal agencies before they can be recommended.

CAUTION: Pesticides can be injurious to humans, domestic animals, desirable plants, and fish or other wildlife if they are not handled or applied properly. Use all herbicides selectively and carefully. Follow recommended practices for the disposal of surplus pesticides and their containers.

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February 2004

Caring for the Land and Serving People

FY03 Accomplishment Summary

October 2002 – September 2003

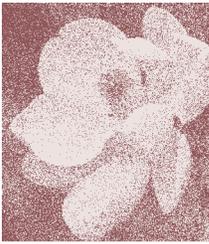
Research work units	26
Publications	743
Refereed publications	253
Patents	1
Publications (SRS) online	3,234
Publication requests filled	
Hard copy	54,600
Electronic	1,600,000
Site tours	276
Presentations	
To scientific and professional societies	615
To lay organizations	198
International activities	97
Conservation Education Intern Program contacts	3,000
Total employees	479
Scientists	128
Budget (research funds only)	\$44,531,000
Awards/grants to States, universities, and other	
Federal agencies (all funds)	\$16,641,315
External funding received from non-Federal	
Sources and other Federal agencies	\$1,229,733
Collaborating organizations	112



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From the Director



It is with great pride that I provide you with this year's edition of *Forest Science in the South*.

This report highlights many accomplishments from this past fiscal year, October 2002 through September 2003 (FY03). In FY03, our budget remained steady, allowing our scientists to continue our successful efforts in meeting our mission.

The USDA Southern Research Station (SRS, the Station) contributes to quality of life in the South by providing the knowledge and technology needed to sustain and enjoy the benefits of the region's forests and waterways. Our scientific workforce collaborates with other scientists in the public and private sectors to produce research results that are useful to forest landowners and managers, commodity associations, conservation groups, educators, legislative bodies, and other agencies.

Guided by the results of the Southern Forest Resource Assessment (SoFRA), the Station has continued to pursue research and development that seeks to ensure sustainability of southern forests. The key findings from SoFRA align well with the "four threats" the Forest Service is using to focus its programs, and with the President's Healthy Forest Initiative. Responding to the SoFRA findings of increased threats by invasive plants and insects, the Station has significantly increased capacity to address southern pine beetle (SPB) and hemlock woolly adelgid problems. SRS scientists have made the first discovery of the Mexican pine beetle, a relative of the SPB, as the agent of extremely damaging outbreaks in the southwestern United States and in Central America. The Station is a leader in the development of a multi-agency and university strategy for combating the insect. The new

publication, *Human Influences on Forest Ecosystems: The Southern Wildland-Urban Interface Assessment*, addresses another of the major threats: urban sprawl and fragmentation.

The Station has kept a strong and steady focus on implementing the annualized forest inventory in accordance with the national Forest Inventory and Analysis (FIA) strategic plan. The FIA unit is now positioned to be on a sustained production schedule by the year's end. Originally commissioned for the southern Forest Inventory and Analysis field organization, the recently published *Nonnative Invasive Plants of Southern Forests*, is immensely popular with natural resource managers and concerned citizens.

SRS personnel from many units worked on the national recovery team following the tragic loss of the space shuttle, Columbia; they provided surveying expertise and GPS technology to pinpoint locations of debris. Many others provided leadership to ground crews of volunteers and local fire and law enforcement personnel. After several months of the recovery effort, about 40 percent of the spacecraft was retrieved—nearly 80,000 pieces.

These are just a few of our accomplishments from this past year; many more are briefly described in the following section. I encourage you to contact us with any questions you may have about the work that we do.

Web site: www.srs.fs.usda.gov

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A handwritten signature in black ink, appearing to read "Peter J. Roussopoulos". The signature is stylized and cursive.

PETER J. ROUSSOPOULOS
Director

Successes— *Our Major Accomplishments*



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Large-Scale Assessment and Modeling

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Southern Forest Resource Assessment Release and Aftermath

The annual Society of American Foresters Meeting in Raleigh, NC, provided an excellent platform for the October release of the *Southern Forest Resource Assessment*, a multi-agency effort guided by the Southern Research Station and the Southern Region of the National Forest System. One highlight of the meeting was a panel discussion featuring Assessment co-leader David Wear and natural resource luminaries.

New products are emerging, including a CD-ROM version of the 600-page book, a summary report, software for customized mapping of the data, and work is beginning on incorporating the Assessment findings in the Station's hypertext encyclopedia. Media coverage of forestry issues has been informed by Assessment results, with one reporter attesting to the value of one credible source of information when trying to sort through conflicting claims from opposite ends of the natural resource spectrum.

Since its release, the Assessment has become a touchstone for those involved in natural resource strategic planning and decisionmaking. Representatives from the Society of American Foresters, the American Forest and Paper Association, and State forestry agencies and associations have used the tax, legal, and other findings to shape their programs and their communications with the public and policy-makers. The Station is taking a leadership role in linking Assessment findings and networks to the Sustainability Roundtable, a national group that has convened regularly for the past several years to recommend conservation strategies for the future of forest resources.

With the Assessment behind him, David Wear returned to his work at the SRS Economics research unit only briefly before being tapped for

two new leadership assignments: first, in kicking off the introductory set of southern Sustainability Roundtable discussions; and second, in chairing the 2010 RPA (Resources Planning Act) timber assessment. The timber assessment, which addresses the most complex and dynamic issues in the RPA portfolio and is the basis of government and private planning, will make use of his ability to deliver results, to elicit differing views of the future supply and demand, and to incorporate future scenarios and issues without compromising scientific quality. ▲

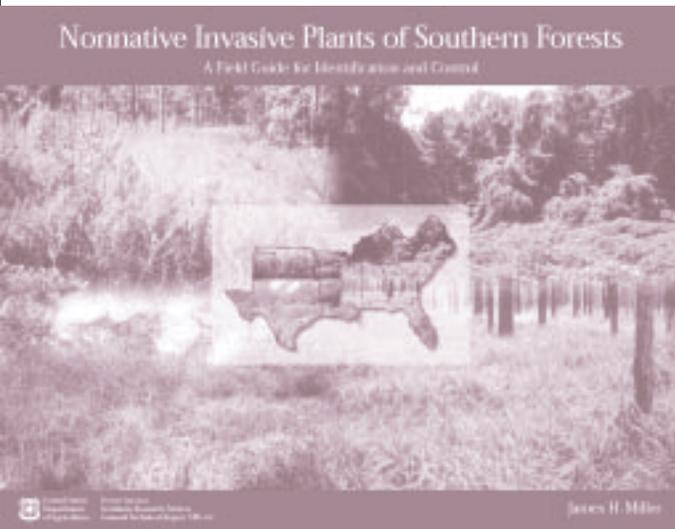


Public input strengthens decisionmaking by reflecting community values. USDA Forest Service

New Field Guide on Invasive Plants

James Miller has published a new guide for identifying and controlling nonnative plants in southern forests. *Nonnative Invasive Plants of Southern Forests*, which focuses on the 33 nonnative plants that are doing the most damage to southern forests, is an excellent resource for audiences ranging from public land managers to homeowners and civic organizations. It starts with easy-to-read descriptions of each plant, its

Large-Scale Assessment and Modeling



Miller book cover; *Nonnative Invasive Plants of Southern Forests* identifies plants and treatment options.

Nonnative Invasive Plants of Southern Forests can be downloaded or ordered at the Station's Web site: www.srs.fs.usda.gov (General Technical Report, SRS-62). Additional resources in the form of group presentations, tutorials, and related materials are available at www.invasive.org to raise awareness and provide training. These presentations and the field guide were part of the materials developed for the first Southern Regional Workshop—Terrestrial Plant Invasions in the Temperate South: the Problem, Consequences and Taking Control—held in Greenville, SC. ▲



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ecology, the plants it resembles, and its history and use. Detailed photographs illustrate how the plant looks in different seasons of the year, including leaves, flowers, fruits, stems, and overall shape.

The book goes on to provide general control guidelines and specific prescriptions for the individual plants, with illustrated directions for applying herbicides to target nonnatives while avoiding damage to native plants. The author stresses that eradication takes several years of treatment and is just one phase of an integrated approach involving rehabilitation, restoration, and many more years of surveillance and retreatment. During this time, native plants that can outcompete and outlast surviving nonnatives need to be promoted or reestablished.

The book got its start as an in-house training notebook for the Station's Forest Inventory and Analysis field crews to survey invasive plants in the South. In 2002, a section on control treatments for invasive plants was added. In less than 3 months of the May publication date, the 7,500 copies from the first printing were exhausted. A second printing of 50,000 followed in August. These copies are now being distributed at no cost to individuals and groups through Web sites, popular news articles, and newsletters, and regional partnerships with extension foresters, State agencies, the Natural Resource Conservation Service, the USDI Fish and Wildlife Service, the National Park Service, and the Department of Defense.

Kudzu...A Special Problem for the South

Kudzu is a perennial, woody vine introduced into the United States from Asia in 1876. It has been used as an ornamental plant, forage for cattle, and erosion control. Unfortunately, it has no natural enemies here so it grows at an incredible rate. Today it is considered a pest that covers millions of acres eating at the edges of forests, climbing utility poles, and covering highway, railroad and utility rights-of-way. The high costs of chemical controls for kudzu make them prohibitive so SRS scientists are exploring biological controls as alternatives.

Working with scientists in China, they found 110 species of insects on kudzu. A number have potential as biological control agents, most promising the purple stem borer. Further testing is needed, but preliminary trials suggest that this and several other potential biocontrols do not threaten common crop plant species in the South. Once testing is completed in China, work will begin under quarantine in the United States with colonies of healthy insects from China. Considerable testing against a wide variety of potential host plants is then required to insure that any insects released into this country will remain on kudzu and not cause damage to native or crop plants. Although this work is time-consuming and long-term, the payoff potential is enormous, both in elimination of unsightly kudzu spreading from rights-of-way to powerlines and trees and in cost savings for forestry, transportation, and utility companies. ▲

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Kudzu planted in Warren County, MS for erosion control in 1939. *USDA Forest Service*

Tribal and Native Plants Initiative

Through a cooperative venture with other Forest Service personnel, the Station has established a virtual nursery program centered in



Theodora Homewytewa, medicine woman of the Hopi Tribe, looks at biological control insects for knapweed at the Salish-Kootenai College. *Jane Gildart*



Arden Comanche and Edward Bigmouth examine a crop of quaking aspen at the Salish-Kootenai College native plant nursery. *Bert Gildart*

Moscow, ID. Outcomes of this effort are publication of the “Native Plants Journal,” engagement with tribal governments through a newly created tribal nursery coordinator position, hosting of tribal nursery workshops and training sessions, and conducting a Tribal Nursery Needs Assessment. The purpose of the Assessment is to determine the current nursery capability within tribes, the native species of interest, and the resources needed to improve their capacity to restore native plants on their lands. ▲

Large-Scale Assessment and Modeling



Harrington Atencio and Terence Julian look at a ponderosa pine seedling in a riparian restoration planting on the Coeur d'Alene Indian Reservation.

Crystal Barnett



Diane Seymour, Allen Wasuli, Tiffinee Bieber, and Sue Antiste are enjoying a tour of restoration sites on the Coeur d'Alene Indian Reservation.

Crystal Barnett



Dawn Thomas, right, shows Joyce Blackwolf some native plant seeds during a workshop at the Salish-Kootenai College.

Kas Dumroese

Progress on Three Management Tools

Decision support systems near completion.

The objective of decision support systems is to help managers take an ecological approach to forest management. In previous years, SRS scientists developed a practical decision analysis process and software (NED-1) and tested them on a 1000-acre tree farm in South Carolina. This year, they tested NED-1 on an 85-acre tree farm in Georgia and produced NED-2, a much improved and expanded version of earlier software that makes decision analysis for sustainable forest management understandable, practical, and affordable.

Southern Appalachian hypertext encyclopedia.

The hypertext encyclopedia project is a new and practical way for scientists to organize and deliver their knowledge. Since the beginning of forestry research, scientists have been looking for a fast, accurate, and inexpensive way to get what they know into the hands of those who need to use it. The advent of the Internet and other technical advancements have come together to make a hypertext encyclopedia a viable solution to this age-old problem. Scientists have developed a system for authors to add or revise content much like they would contribute to a journal. The typical author would have written a number of peer-reviewed journal articles and would then extract the "pay off" knowledge from those articles to contribute to the encyclopedia. All authors get passwords and working space for drafting material online. Peer reviews are also conducted online. After clearing the peer-review process, new contributions are "published" for all users to view. This ongoing project may be viewed on the Internet at www.forestencyclopedia.net.

Updated growth and yield models.

Plantations must be profitable for landowners if required investments are going to be made. Models such as VB Merch-Slash and VB Merch-Lob were developed as tools to help landowners make investment decisions by providing estimates of harvest values for thinned and unthinned plantations of slash and loblolly pine. Station scientists updated VB Merch-Slash and VB Merch-Lob so that landowners can convert



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predicted stand tables into an estimated optimum product mix using a dynamic programming algorithm, written in Visual Basic, that maximizes the selling value of the stand. With the updated models, landowners can develop management scenarios, develop harvest values, and come to an informed decision about their appropriate level of plantation investments. The models forecast product volumes and stand values for stands partitioned into 1-inch diameter-breast-height-classes at any stage of plantation development from ages 10 through 50. The variables required to run the programs are age, density, site quality, minimum and maximum dimensions of products, and product prices. ▲

Textbook Ready for the New Academic Year

Karen Abt led an effort to develop *Forests in a Market Economy*, a state-of-the-art review of both classical and emerging themes in forest resource economics that demonstrates how economic principles can be used effectively to analyze forest policy issues. Contributing authors were the scientists from the Economics research work unit in RTP, NC as well as others from North Carolina State, Colorado State, and Duke Universities, the Research Triangle Institute, and the Universities of Wisconsin, Georgia, Florida, Nevada, Minnesota, and Maine. The book, published by Kluwer Academic Publishers, is intended for forest economists, forest policy analysts, and graduate students studying natural resource economics.

Forest sustainability is increasingly tied to the decisions that private landowners make in response to market forces and changing values. Forest policies can be designed to promote sustainability by influencing market forces and having direct economic impacts. The book offers a range of sophisticated methods to quantify forest market processes, identify timber and nonmarket forest values, and measure the effects of forest policies. It shows how economic principles can be used to analyze forest policy issues across existing and developing market economies in the United States, Latin America, and South and Southeast Asia.

The chapters encompass traditional and modern areas of concern in forest policy, including timber production and markets, multiple-use forestry, and valuation of nonmarket benefits. These topics were developed with case studies that demonstrate rigorous empirical analysis in a manner accessible to readers with a background in microeconomic theory and statistics. The first three chapters provide an introduction, a summary on the status of the world's forests, and the current state of research on private forest management. The remaining chapters are divided into three sections that cover timber production and markets, multiple products from forests, and nonmarket valuation. Chapters on multiple products include the economics of forest carbon sequestration, the importance of nontimber forest products to rural households, and the adoption of agroforestry by private landowners. ▲

Structure and Responsiveness of Southern Forest Product Markets

Scientists from the Economics unit led a series of studies to determine whether the law-of-one-price applies to timber and finished products. Although their results generally confirmed the law-of-one-price for softwood and hardwood lumber markets, southern markets were not perfectly integrated, with only limited geographic subsets following the general law. Hardwood lumber prices are not integrated across species within grades.

These findings suggest that standard aggregate economic approaches to measuring the impacts of natural disasters are inadequate for evaluating effects on timber markets and must be adapted to the specific circumstances of southern markets. Findings also indicate that while timber markets are not integrated, they are linked in a systematic fashion, possibly through integration in markets for lumber, paper, and other products in higher stages of production. Hardwood markets for individual species are either independent or not related in any stable statistical fashion.

The findings also suggest that the effects of policies on southern markets are persistent, not temporary, and that they may have more of a

Large-Scale Assessment and Modeling

local impact than they would if the markets were perfectly integrated. ▲

Understanding Landowner Decisionmaking

Criteria for adopting technology.

In cooperation with North Carolina State University and the Research Triangle Institute, SRS scientists completed a meta-analysis of 120 empirical studies on adoption of forestry, agroforestry, and soil conservation technology by small forest landowners. Five broad categories of factors were found to explain technology adoption in an economic framework: preferences, resource endowments, market incentives, biophysical factors, and risk and uncertainty. Of these, the most important were risk and uncertainty, biophysical conditions, and resource endowments. If generalized to a broader family of silvicultural options available to landowners, these results could be valuable in designing programs that promote tree planting, conservation planning, and ecological restoration.

Owner awareness of tax incentives is uneven.

The Federal tax code is vast, with even the forest-related provisions complex and constantly changing. Recently, nonindustrial private forest owners in South Carolina participated in a survey to gauge awareness of beneficial Federal income tax provisions. All of the participants belonged to a forest owner organization, which means the results may be more representative of owners who are relatively active and financially motivated than of southern owners in general.

Owner awareness of two provisions available to taxpayers—treatment of qualifying income as a long-term capital gain and annual deduction of management expenses—was high at nearly 80 percent. But little more than half of the owners knew about three provisions intended specifically for them: the reforestation tax credit, the reforestation amortization provision, and the ability to exclude qualifying reforestation cost-share payments from gross income. Owners who

knew about the beneficial income tax provisions were more likely to belong to a forest owner organization, have a written forest management plan, and have a high household income.

The study findings confirm the need for continuing to improve nonindustrial private forest owner awareness of the Federal income tax provisions designed to benefit them. As well, the findings suggest two areas where public or private action might improve owner awareness and use of beneficial tax provisions: encouraging and assisting forest owners to develop written forest management plans and encouraging them to join a forest owner organization. Increased owner knowledge and use of beneficial tax provisions would lower the cost of forest ownership and management, reduce pressure to fragment forest holdings, and enable owners to practice higher levels of management and stewardship. ▲

Study Gauges Public Support of Amenity Values

SRS scientists developed new methodology for estimating the nonmarket value of alternative forest management systems and demonstrated an application of the methodology in Maine. The study shows public willingness to pay a considerable amount for forest management practices that reduce the impacts of timber harvesting, suggesting a concern with a variety of forest amenities that include recreational opportunities, wildlife habitat, and aesthetically pleasing views as well as timber.

The findings are consistent with previous observations that contingent forest values vary in predictable ways, implying that there may be unobserved spatial patterns to forest values. These, in turn, provide input for local land use planning decisions. This study indicates that carefully conducted citizen surveys can help forest managers and policy makers identify management alternatives preferred by the public and that such information can add balance to public debates. The methodology is currently being extended and refined for application to forest ecosystems in the South. ▲



Large-Scale Assessment and Modeling



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Successes— Our Major Accomplishments

Two Studies on Assessing Wildfire Risk

Risk assessment system for local governments in development. SRS researchers are working with the Southern Group of State Foresters and Space Imaging Corporation to develop a Wildland Fire Risk Assessment System in support of local fire management and risk analysis planning. The methodology, which will employ geographic information and remote sensing mapping technologies, is a well-defined and repeatable process for describing fuels and analyzing wildland fire risk at any scale of operation. The project entails the collection and mapping of county-level wildfire fuel loading data. Once the project is completed, States will be better equipped to communicate fire risks to the public and fire professionals will have a dynamic set of tools for consistently evaluating site-specific risks across the region, reducing the tremendous human and property loss caused by wildfire.

Predictors of wildfire risk evaluated. SRS scientists are helping to clarify how a set of variables determines the probability and extent of wildfires in western and southern forests. At a broad scale, they used current year climate—the most important factor that in explaining yearly variations—to organize wildfire patterns on different parts of landscapes.

Their findings suggest that during a catastrophic wildfire year, wildfire risk at these parts of the landscape is affected by fine-scale variables such as road networks, stand and neighboring forest types, site-specific wildfire history, and understory vegetation.

Management activities may also play a role. Although broad measures of the wildland-urban interface and vegetation management have little effect on county wildfire risk in Florida, timber harvesting without subsequent fuel reduction increases wildfire risk. Previous wildfires on a site reduce the probability of fire in the current year, a suppressive effect that lasts between four and twelve years. Efforts to mitigate wildfire risk through prescribed fire and other fuels management efforts have small or negligible

effects on wildfire risk.

The results show that wildfire risk in the West can be predicted several months before the wildfire season using indices of drought recorded in the months and years before the current wildfire season. The degree of predictability varies across the region. These findings are being incorporated into forecasting models and will be useful in placing suppression resources and in planning vegetation management activities. ▲



Congested landscapes result in fire that increasingly threatens humans, domestic animals, wildlife, and structures. Florida Division of Forestry

Large-Scale Assessment and Modeling

Burn Study Results Vary in Different Ecosystems

Longleaf pines in the Gulf and Atlantic Coastal Plains. For the last 40 years, SRS scientists have maintained studies in Florida, Georgia, Louisiana, and South Carolina to determine which dormant-season fire-return interval will best control the buildup of fuels and with what long-term ecological effects. This information will help natural resource professionals to design efficient and cost-effective prescribed burning programs to restore longleaf pine ecosystems.

The studies showed that in the Carolinas and Louisiana, multiple applications of annual or biennial burning changed the structure of longleaf Coastal Plain understory communities, enabling managers to use repeated burns to shift the community to a more diverse and natural structure.

Longleaf communities of Florida and Georgia respond somewhat similarly but are more resistant to change. Thus, dormant season burning, no matter how frequent, will not be sufficient to restore these communities to more natural conditions. Restoration will require burning during the growing season or application of additional treatments.



Wolf spider (*Lycosa hellua*) habitat may be affected by frequent burning.

Although burning reduces the diversity of ground-dwelling insects and other arthropods, the effect is short lived for most species. Exceptions in this study were 42 Florida and Georgia arthropod species whose populations were reduced by burning—an effect that remained after 4 years without fire. Arthropods serve many important ecological functions in forests, as pollinators for flowering plants, as sources of food for birds and small mammals, and as scavengers in removing dead animal and plant material from the land. The Florida and Georgia results suggest that some sites may need to be set aside as refugia for arthropod species that fail to recover after prescribed burning.

Mixed pines and hardwoods of Piedmont Carolina. SRS scientists are participating in a national study on the ecological and economic consequences of fuel-reduction treatments in a variety of forest types and conditions. The results of this work will enable managers to base their recommendations on predicted outcomes of numerous components of an ecosystem and to balance fuel-reduction needs with overall management objectives. In the southeastern Piedmont, where landowners often allow fuels to accumulate, study plot treatments consisted of prescribed burning, commercial thinning, and thinning followed by burning with some areas highly disturbed by skid trails and others left undisturbed. Early results show that fuel reduction treatments impacted ecosystem structure in widely different ways: (1) wildfire severity varied somewhat by landscape position but generally decreased in all but the thin-only treatment; (2) bird and insect populations were unaffected by all treatments although foliage-gleaning and cavity-nesting species increased in thinned areas; (3) the thin-only treatment increased the species diversity of snakes; (4) bat habitat improved following treatments that reduced overstory density; (5) all treatments produced small changes in soil composition and chemistry, but none that are long-term.▲



Large-Scale Assessment and Modeling



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Successes—Our Major Accomplishments

Symposium on Management to Offset Greenhouse Gas Emissions

In response to global warming, there is a need for basic information about the cycling of carbon and other greenhouse gases through terrestrial ecosystems and how to identify where terrestrial ecosystems can be managed to optimize carbon sequestration and reduce greenhouse gas emissions. The USDA Program Manager for Global Change commissioned the Southern Global Change Program to host the official *USDA Symposium on Natural Resource Management to Offset Greenhouse Gas Emissions*. The symposium had three goals which were to: (1) provide a forum for scientists to present the most recent breakthroughs in science and technology developments relevant to storing carbon in managed terrestrial systems; (2) transfer information about new scientific findings, new technologies, and program information to scientists, program managers, policy makers, and the private sector; and (3) enhance collaboration and partnerships within USDA and with other Federal, State, and private organizations. The symposium was also used to further USDA participation in the President's National Climate Change Research Initiative and National Climate Change Technology Initiative, and to meet USDA's two-year-old plan to have a carbon sequestration conference for agricultural and forestry management.

The meeting was attended by a total of over 200 scientists, policy makers, and land managers. Over 120 papers or posters were presented in concurrent sessions during the three-day symposium. The international meeting drew attendees from eight different nations, and the leaders of carbon sequestration research in forestry, grassland, agricultural, wetland, desert and urban ecosystems. In addition, key Executive Branch Administration personnel attended and presented papers at the meeting, including the Assistant Secretary of Commerce for Oceans and Atmosphere and Director of the Climate Change Science Program of the Interagency Working Group on Climate Change Science and Technology, Jim Mahoney, and the Chief of the National Resources Conservation Service, Bruce Knight. ▲



Smokestack emissions represent a major component in greenhouse gases.

B. Lea

Large-Scale Assessment and Modeling

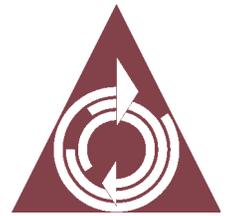
Other Significant Accomplishments

- ▶ Characterized the status of underserved forest landowners in rural Alabama and their history and involvement with land management.
- ▶ Developed a modification to the Fosberg fire weather index that adds a fuel availability factor using the Keetch-Byram drought index, which improves the relationship between the fire weather index and the area burned estimate. ▲

Awards

James Granskog was elected a Fellow by the Society of American Foresters, “In recognition of outstanding service to forestry and the Society of American Foresters.”

John Schelhas was elected a Fellow by the Society of Applied Anthropology. ▲





Urban Forestry/ Wildland-Urban Interface

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The Southern Center for Wildland-Urban Interface Research and Information Publishes Assessment

Human Influences on Forest Ecosystems: The Southern Wildland-Urban Interface Assessment examined interface issues for the 13 southern States. The publication was the first of its kind in the Forest Service and has national significance.

The wildland-urban interface represents an area where increased human influences and land conversion are changing natural resource management and benefits. The interface results from an increase in population growth, profitable economic and tax incentives, and favorable land-use planning policies. With urbanization, the environment is altered, which influences the availability of forest and other natural products, affects how we manage natural resources, and increases the risk to human health and property.

The Assessment identified four major themes that characterize the interface:

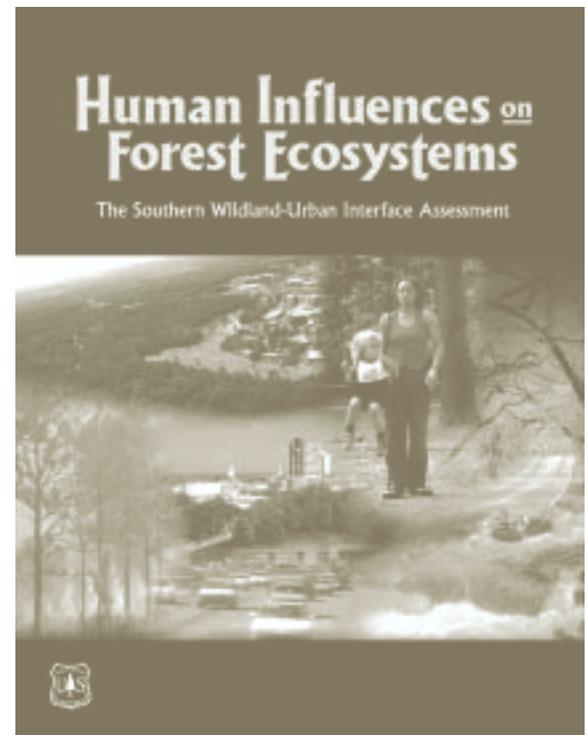
- 1) Wildland-urban interface issues are about people;
- 2) Public policy plays an important role in creating and solving interface problems;
- 3) Interface issues are interdisciplinary; and
- 4) Interface issues involve multiple ownerships, jurisdictions, and scales.

In addition, the Assessment identified research needed to develop the skills, tools, and information to manage current resources and to plan future development in the interface. Without these skills, tools and information, natural resource managers, land-use planners, and others will be ill-equipped to make decisions that will minimize the effect of urbanization on the environment and the goods and services humans need to survive. Research needs can be

summarized into four main areas:

(1) understanding and communicating how public attitudes, values and perceptions change with urbanization and the subsequent effect on public policy; (2) identifying how public policy affects forests and other natural systems and their management; (3) identifying and evaluating how human influences affect the forest and its environment; and (4) identifying and reducing catastrophic effects of fires and flooding on humans and environments found in the interface. These four research areas have been synthesized into four research problems defining the research work unit description for the Southern Center for Wildland-Urban Interface Research and Information. The Assessment was highlighted in the SRS quarterly publication, *Compass*, which lists current published articles and books. ▲

The *Southern Wildland-Urban Interface Assessment* was published in 2003.



Urban Forestry/Wildland-Urban Interface



Understanding the Socioeconomic Aspects of Sustainability

Forests are both valued by people and influence people through many complex relationships. Race and ethnicity are a key social dimension in human relationships to forests and natural resources. Despite its importance to understanding social relationships with forests in the South and elsewhere, the role of race and ethnicity in natural resources has not been systematically explored. To address this gap in the literature and to provide a firm foundation for our research program on sustaining people and forests in the South, a review of the literature on this topic in the United States was undertaken by the Legal, Tax, and Economics unit in New Orleans, LA. The resulting review paper, *Race, Ethnicity, and Natural Resources in the United States: A Review* was published in *Natural Resources Journal*, a multidisciplinary journal focusing on public policy issues in the study of natural and environmental resources that is published by the University of New Mexico School of Law.

The article reviews the literature on racial discrimination and ethnic differences in valuing and using natural resources. The review indicates that the effects of past and current racial discrimination and ethnocentrism in the natural resource field continue to be felt today, both in individual behavior and social structures. The review also finds complex linkages between culture and values, natural resource uses, social organization, and ecosystem characteristics that highlight the need for serious attention to racial and ethnic diversity in natural resource management and policy.

Another article, "African American Land Memories", (to be published in *Environmental Ethics*), explores the historical relationship African Americans have had with wildlands, primarily in the South. The middle-American view of wilderness and wildlands constructs these terrains as refuges—pure and simple, sanctified places without human modification. To the contrary, this research from the Recreation, Wilderness and Demographics Trends unit in Athens, GA, proposes that wild, primitive areas

do not exist in the minds of all Americans as uncomplicated or uncontaminated places; and that for African Americans in particular, the relationship to wildlands is an ambiguous one. On the one hand, empirical findings from prior research shows Blacks engage actively in wildland-related activities such as fishing, but are less likely to participate in recreation like camping or hiking. The paper is a theoretical piece which considers the role of "collective memory" (shared ethnic/racial memories and experiences) in the Black relationship to wildlands. In considering the relative lack of Black visitation to wildland recreation areas on national forests and other areas, researchers propose that the Black land experience is mitigated by an ethnic or collective memory of hardships involving forest labor (for example, turpentine), plantation agriculture, sharecropping, and lynching. The paper considers the impact of these three labor-related institutions and terrorism on Black perceptions of wildlands.

There are a number of benefits to fostering a systematic understanding of the role of race and ethnicity in natural resources. An outline of the key dimensions of race, ethnicity, and natural resources provides a foundation for our research program on minority and limited resource landowners and forests in the South. It will help foster a broader and more inclusive view of natural resource values, use, and management that will both better serve a diverse population and attract more diversity to the natural resource professions. The information will provide this broader framework to social science and other researchers, to managers and policy makers, and for use as a key reference in the curriculum of university forestry and natural resource programs. ▲

Vertical Smoke Distribution from Prescribed Fires

Approximately 4 to 6 million acres of forest and agricultural land is subjected to prescribed fire each year in the South. Over the past several decades, the population growth of the south has created an enormous wildland-urban interface. Concurrently, with increasing acreage being devoted to forestry, there has arisen a need to

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Distribution of smoke from wildfires and prescribed burning. USDA Forest Service

increase the frequency of prescribed fire both from forest health and forest protection perspectives. Smoke production has decreased air quality and threatened human health. The result is increased regulation with the threat of curtailing prescribed burning at a time when more prescribed burning needs to be done.

Most methods to estimate smoke dispersion from prescribed burns are based on the ability of the “mixed” layer of the atmosphere to remove smoke from a burn site. The formula, the product of the wind speed and the depth of the mixed layer, defines the rate at which a volume of air above a burn site that is able to contain smoke is replenished by fresh air. It is assumed that all of the smoke produced from the burn is contained within the mixed layer. The study on vertical smoke distribution tests this assumption. An aircraft equipped with a high response temperature sensor was flown alongside and over a smoke plume from a large prescribed burn. Periodically the aircraft was flown in a cylindrical pattern from 500 feet to at least 1000 feet above the height of the plume. The temperature

recorded during the flights identified the mixed layer, the upper boundary of the mixed layer, and the stable atmosphere above the mixed layer. It was found that approximately 30 percent of the depth of the plume was above the mixed layer.

While this study is not yet finished, if additional flights show similar results, it will have been shown that the amount of smoke available to degrade air quality for several miles downwind of a prescribed burn is less than what is currently estimated by assuming that all of the smoke is contained within the mixed layer. This means that it may be possible to relax some of the restrictive regulations on prescribed burning. Land managers who engage in prescribed burning may be able to increase the acreage in their burning programs. It may also become easier to burn near subdivisions and other sensitive targets knowing that much of the smoke is actually lofted above these sites. In addition, regulatory agencies may be able to reformulate air quality algorithms based on information on how smoke is actually distributed in the atmosphere. ▲

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National Recreation Surveying and Monitoring

Research to provide up-to-date information on outdoor recreation trends, public environmental values, and the potential effects of demographic shifts on both continues within the Recreation, Wilderness, and Demographic Trends Assessment Group in Athens, GA. Much of this work is being done for the 2005 National Renewable Resource Planning Act (RPA) Assessment Update. This research is also being used by private industry, other Federal agencies, and State planners. The core data collection instrument is the multiple-agency sponsored National Survey on Recreation and the Environment (NSRE). Included in the study are related topics including equitable access to public lands, public access to private lands, preferences for national forest management options, public knowledge and perceptions of congressionally designated recreation areas, wilderness values, and changing conditions at the wildland-urban interface. Results from this work are in press as a book through Venture Press and in numerous journal and proceedings articles.

In addition to this population-wide survey, work is underway to improve and operate the National Visitor Use Monitoring System (NVUM) for application on all national forests

across the country. Improved measures of recreation use and opportunities on forest lands nationwide have been implemented. The NVUM program uses on-site interviewers to obtain information from about 20,000 visitors on 30 national forests per year. The information collected in the field is then analyzed to provide visitor use estimates and descriptions of visitor characteristics including satisfaction with National Forest experiences. Research is underway to better understand public perceptions of wildfires and managed fires on forest and range lands and their effects on recreation participation.

National Forest wilderness use and values are being studied as well. This work was used for the 2003 Nation's Report on Sustainable Forest Management, Indicators 42 and 43, social, cultural, and spiritual values. It is also a part of the Forest Service's RPA Assessment. New research has determined that values associated with wilderness visitation are significantly less for minorities, females, immigrants, and less educated people than for others, such as white males. However there were practically no differences among these demographic grouping relating to nonuse and preservation values of the National Wilderness Preservation System. New research

Recreation use on National Forests. B. Lea



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is being conducted to examine perceived constraints to wilderness use across social strata.

Continuing research includes expanding a study examining the economic benefits of trees in multiple suburban settings; estimating the demand for and economic and social benefits of abandoned railways, power line rights-of-way, waterways, and integrated urban trails; assessing urban/non-urban recreation behaviors, preferences, and values. New research includes studies to assess the public's attitude toward user fees; assess the urban public's attitudes, preferences, and use of urban green infrastructure; examine the role of acculturation in immigrant environmental preferences and behavior. Published research findings indicated that combining stated and revealed behavior information from tourists enhances decision models and establishing a rail-trail in Central Georgia would lead to more than \$7 million in annual economic benefits to users.

The methodologies and results from these intensive survey efforts are in great demand nationally and internationally. The Outdoor

Forested lands intermixed with rural uses have special management considerations. USDA Forest Service

Recreation Trends research work unit in Athens, GA responds to a high rate of consultation requests monthly. Much of this work is part of a book being published under contract with Venture Press in Pennsylvania.

The National Outdoor Recreation Supply Information System (NORSIS) is a spatial data base developed to measure the outdoor recreation supply situation and trends in the United States. It includes data across all Federal, State, local, and private areas, dedicated sites, facilities and services in the country. The goal of NORSIS is a national inventory to show the supply side of outdoor recreation; the information feeds into the RPA Assessment. ▲

Interactions between Forest Management and Rural Communities

A major gap in the knowledge of identifying the links between recreation and related amenity resources and the economic and social quality of life in southern rural communities is reliable estimates of the current volume of recreation visitation to public lands. Through the National Visitor Use Monitoring (NVUM) program, this gap is being addressed.



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During FY03, data were collected that will enable estimation of recreation and Wilderness visitation on the Chatahoochee-Oconee National Forest (NF) and the National Forests in Texas. These data complete the set of visitation estimates for all southern forests. Estimates of visitation levels and characteristics of that visitation were developed for the Daniel Boone NF, Cherokee NF, Francis Marion-Sumter NF, and National Forests in Mississippi, and Land Between the Lakes in the previous 2 years. Visitation estimates for the complete set of southern forests will be accomplished within the next 5 months. These data will enable the first comprehensive analysis of the role of national forests in serving the recreation needs of rural populations in the South.

Through analysis by cooperators at Michigan State University, primary spending segments within the visiting population have been identified, and the relative magnitudes of spending by these segments were estimated. Manuscripts, conference presentations, and other technology transfer activities detailing these results are currently under development. Incorporation of these results into forest plan revisions is already underway.

Related work with Michigan State and the Human Dimensions module in the Natural Resource Information System has continued to develop geolocation codes for sampling points on national forests in the NVUM process. The access platform to link these data with other relevant spatial coverages, including incidence of invasive species and problems with unmanaged recreation, has been conceptualized. Research documenting the role of wildlands and especially designated Wilderness is continuing in cooperation with West Virginia University. Through several cooperators, including both university staff and other SRS scientists, research has been initiated that will begin to identify the nature and strength of relationships between resource condition, population characteristics, recreation visitation, and related economic activity. ▲

Improving Termite Control Techniques

Conditions regulating native subterranean termites in natural habitats are poorly understood. SRS scientists continued several ongoing studies and initiated preliminary research aimed at understanding termite diversity, distribution, abundance, and role in forest ecosystems. Termites have been collected and mapped from more than 465 forest locations in northeast Mississippi. This research will provide improved understanding of the biological, ecological, and physical parameters supporting each species. They also sampled woody debris containing and devoid of termites from upland and bottomland hardwoods and pines. Decay fungi were cultured and isolated from the samples, and the fungi are presently being grouped and identified. This research will promote an understanding of the relationships among fungi, habitat, and termite species. Additional research will identify the fungi that attract/repel termites or serve as feeding stimulants or inhibitors to termites. Researchers will also examine the underlying modes of action causing the altered termite behavior, supporting the development of improved control strategies.

Scientists wrote a proposal and initiated preliminary research to evaluate methodologies for studying termite activity (for example, an acoustical detection system developed by the National Center for Physical Acoustics, University of Mississippi) and wood decay in pine logs (e.g., a Digital Microprobe® [Sibtec]). In a similar study, they evaluated the feasibility of using acoustical detection methods to determine the effects of slow acting nonrepellent termiticides on termite activity and feeding.

Preliminary research was initiated to evaluate methods of collecting termites from the same colony through time—a capability with important research implications. Sudan Black and Sudan Red stains were investigated for use in marking termites, with the former resulting in high termite mortality in the laboratory and the latter apparently too ephemeral for mark-release-recapture application in the field. Delineation of colonies using agonistic/antagonistic behavior has begun.



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Successes—Our Major Accomplishments

Data were analyzed on the effects of catnip oil on termite mortality and behavior. Termites did not tunnel into treated sand, and the oil was found to act as a fumigant. Catnip oil did not persist in the soil, indicating that it would not be an effective commercial treatment against termites. Research led to a study with a Mississippi State University statistician aimed at determining the statistical validity of repellency tests.

Scientists also investigated the transfer of two nonrepellent termiticides and a repellent termiticide among termite colony members. Data indicated transfer among nestmates of both nonrepellent compounds, and no transfer of the repellent compound. This research was supported, in part, by three agreements with industry. ▲

Invasive Species: the Formosan Subterranean Termite

The Formosan subterranean termite is an invasive pest of growing importance in the southern United States. This insect attacks living trees, potentially threatening forests of the wildland-urban forest interface. Damage to forests is caused by feeding termites that weaken trees and subject them to wind throw and there is indirect damage to the forest ecosystem through disruption or displacement of native termites that promote wood decomposition and nutrient cycling — events that could compromise forest health and productivity. Researchers contributed to an extramural project investigating the transfer of two nonrepellent termiticides (Premise 75[®], and Termidor SC[®]), among Formosan colony members. Results showed a significant increase in mortality among recipient termites when donors were exposed to sand treated with 100 ppm of either compound. This research suggests that some termiticides have the potential to extend their killing power through the colony by being passed among nestmates. ▲

Registration of New Termite Control Products

Virtually all termite control products undergo Forest Service testing before being registered by State and Federal regulators. Tests are performed on repellent and nonrepellent termiticides, chemically impregnated and physical barriers, and other novel products. Products undergo 24 months of laboratory screening and five years of field testing in Arizona, Florida, Mississippi, and South Carolina. This year researchers collected efficacy data on two termiticides in the laboratory and 18 termiticides and five impregnated barriers in the field. Two new termiticides and one impregnated barrier were installed at the four sites. Tests were administered through 28 agreements with industry. Scientists also collected field data on seven termiticides and one physical barrier from expired agreements. Results contributed to the conditional registration by EPA of the first chemically-impregnated termite barrier, Impasse[®], (Syngenta[®]).

Four research studies continued on the efficacy and longevity of registered termiticides at the four test sites. Fipronil[®] killed greater than 90% of the termites one year after application and reduced termite penetration through the treated soil. Cyfluthrin, cypermethrin, and fenvalerate remained toxic and repellent to termites 6-10 years after application. Twelve years after application, Dursban[®], elicited the greatest termite mortality compared to the pyrethroids: Demon[®], Prevail[®], Tribute[®], and Dagnet[®]. Termites penetrated to a depth of 50% through Dursban[®]-treated soil. Tribute, was most effective at preventing soil penetration among the four pyrethroids. Among bifenthrin, chlorpyrifos, deltamethrin, and imidacloprid tests established in 1998 in Mississippi, chlorpyrifos produced the highest mortality while deltamethrin produced the highest repellency to termites. Lowest mortality and least repellency were found with imidacloprid. Test site did not influence mortality or soil penetration. ▲

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Other Significant Accomplishments

- ▶ Reviewed and commented on the new Florida Termiticide Efficacy Rule as a proposed national standard for liquid termiticides and termite baits.
- ▶ Received U.S. Patent 6,524,605 for biorational repellents obtained from terpenoids for use against arthropods; assigned to Iowa State University Research Foundation.
- ▶ Presented talk titled, *Vegetation Patterns of Upland and Riparian Forest Patches along Urban-Rural Gradients* at the International Association of Landscape Ecology World Congress in Darwin, Australia.
- ▶ Delivered three papers at the American Planning Association National Conference: *The Wildland-Urban Interface: An Introduction; Policy in the Wildland-Urban Interface; The Wildland-Urban Interface: Urban Influences on Forest Ecosystems.*
- ▶ Presented a keynote address, *Mega Social Forces Shaping Management of Urban National Forests in the Future*, at the National Forum on Urban National Forests.
- ▶ Gave presentations at the American Forests National Urban Forestry Conference: *Wildland-Urban Interface Issues and Approaches; Human Influences on Forest Ecosystems; Communication Tools for the Wildland-Urban Interface, Trees in the Residential Landscape: an Hedonic Study of Property Valuation and Economic Incentives that Drive Green Infrastructure.*
- ▶ Continued work within multinational group of social scientists under the auspices of the International Union of Forest Research Organization on improving designs and methods for national outdoor recreation assessments.

In this country, prepared demand analysis reports in support of Statewide recreation planning for California, Colorado, Texas, Delaware, Missouri, Nevada, South Dakota, Tennessee, and Vermont.

- ▶ Presented a paper at the Rural Sociological Society meeting in Montreal, Canada on the impact of urban sprawl on resource dependent, rural communities. ▲



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Awards

The Regional Forester's (Region 8) Excellence in Technology Transfer Award 2003 went to the Southern Center for Urban Forestry Research and Information and the Southern Center for Wildland-Urban Interface Research and Information.

Ingrid Sather of the Southern Center for Urban Forestry Research and Information was a member of the National Technology Transfer Team which received a Chief's Award for Excellence in Technology Transfer for exhibiting extraordinary national leadership in Technology Transfer for Urban and Community Forestry. ▲



Inventories and Monitoring

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Forest Inventory and Analysis

With the periodic forest inventory surveys having been completed the past year, North Carolina Units 3 and 4 (Piedmont and Mountains units) were processed through the legacy (periodic) compilation system. The Forest Inventory and Analysis (FIA) research work unit began converting to annualized inventories in 1997. The annualized inventories now include 11 of the 13 southern States; the exceptions are Mississippi and Oklahoma. So far, South Carolina inventory cycle 3, Virginia cycle 3, Kentucky panels 1-3, 3 panels for Texas, Tennessee panel 2, and Arkansas panel 2 were run through the new

compilation system. The continuing development of SRS Compilation System consisted of modules to compile data collected using national procedures, fine tuning of existing modules, and developing special remeasurement modules for several States.

Analytical and reporting accomplishments included distributing FIA data to State Foresters in Kentucky, North Carolina, Texas, and Virginia, and public release of FIA data for South Carolina, Virginia, Georgia, Tennessee, and Arkansas. In addition, a Texas proposal to begin annual inventory implementation in west Texas was initiated.

The quality assurance/quality control plan was revised in FY03. Changes reflect current protocols in the collection of data, and ensure the data is high quality, accurate, consistent, and timely.

Periodic forest inventory surveys have been conducted for the 13 southern States since the 1930s.

C. Davis



Inventory and Monitoring

Use of nontraditional aerial imagery tools in the preparation of field materials provided to the States resulted in overall gains in efficiency and quality of phase I data collection, as well as improved inputs to data processing systems. Remote sensing applications and rapid classification of Landsat Thematic Mapper imagery, as well as cooperation with scientists at the Tree Quality, Processing, and Recycling unit in Blacksburg, VA, to develop a video camera based on an optical dendrometer for operational use in special forest studies is providing cutting-edge technology for the FIA program.

A system to track the workflow from data collection to publication was initiated, including a weekly summary report and an online documentation system. Web-based query tools were created for editing, custom reporting, plot and panel tracking, and checking cruiser progress, which is available to all FIA cooperators.

During the last 5 years, the southern FIA unit has gained approximately \$6,250,000 in partner contributions through cooperative agreements with 11 States to implement annualized inventories, while producing 162 publications. FIA has completed two unit reports for close-out periodic inventories currently in review and collected data on approximately 60,000 forested and nonforested field plots representing approximately 360,000,000 acres.

FIA initiated or maintained cooperative ventures with university scientists and other research stations:

- Partnered with University of Georgia on a study titled *An Assessment of Timberland Loss and Fragmentation Associated with Urbanization in Georgia*;
- Partnered with Virginia Polytechnic Institute, the North Central Research Station, and the National Council of the Paper Industry for Air and Stream Improvement, Inc. on a study titled *Satellite Remote Sensing for FIA Forest Area Estimation*;
- Cooperated with Michigan Technical University and the Rocky Mountain

Research Station on a study titled *FIA Model Licenses Agreement*;

- Cooperated with Mississippi State University on *Agenda 2020: Estimating Forest Area by Type and Delineating Stand Characteristics With a New Generation of High-Resolution Area Sensors*. ▲

Forest Health Monitoring

Forest ecosystem health has gained attention in recent years because of environmental concerns about air pollution, acid rain, global climate change, population growth, and long-term resource management. In response to public concerns, several Federal and State agencies have joined in developing a program for monitoring and reporting on the current status, change, and trends of forest ecosystem health. The Forest Health Monitoring (FHM) program is a direct result of collaborative effort and common purpose. The Forest Service and State forestry and agriculture agencies conduct FHM activities in cooperation with other Federal, State, and university partners, including the USDI Bureau of Land Management, the U.S. Environmental Protection Agency (EPA), the Tennessee Valley Authority, the USDA Natural Resources Conservation Service, and several universities. The National Association of State Foresters provides essential program support, guidance, and assistance.

Plot and sampling designs are critical elements of inventory and monitoring, and important statistical linkages of the results can best be made among compatible designs. To overcome past problems in linking results due to design incompatibility, FHM and FIA are using a common, fixed-area plot design and are moving toward sampling all forest lands based on a common sampling grid. FIA and national forests collaboratively conduct forest inventories on National Forest System (NFS) lands and will use the fixed-area plot design in new inventories. A common sampling grid improves integration of FHM, FIA, and NFS monitoring and inventories which are done at different intensities.



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Mainland development threatens productive estuary near Croatan National Forest, NC

B.Lea

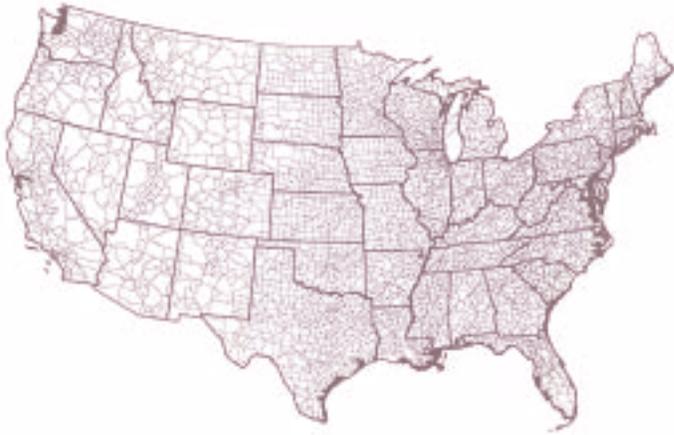
In FY03, FHM published new methods on how to localize national fragmentation statistics. The work represents a cutting edge achievement because it is the first time that anyone has successfully conducted an analysis of forest fragmentation at national scale with such high-resolution landcover maps. This is also the first time anyone has developed methods to localize national forest fragmentation statistics by forest type. This research has produced fundamental insights gained about forestland patterns in the United States. FHM also published two separate national assessments of forestland fragmentation, one for the *US 2003 Report on Sustainable Forests* (part of the Montréal Process) and one to demonstrate an alternative approach at a national scale.

In addition, FHM contributed national fragmentation statistics to the H.J. Heinz Center's *Environmental Report Card*, which was published in book form this year. All the research and subsequent applications are based on national landcover maps derived from Landsat Thematic

Mapper imagery for the United States. All the results and maps generated by this research have been made available to other researchers and the public via the SRS Web site. The Station's FHM methods are gaining international attention and the Station is currently developing cooperative arrangements for international applications. The research databases are continuing to be used by the EPA as part of their Regional Vulnerability Program, which is assessing future impacts of urbanization in the mid-Atlantic region, and by the USDI Geological Survey, which is developing large-area habitat models to evaluate reintroduction strategies for wildlife species, such as the Florida panther and the black bear in the southeastern United States.

To make it feasible for one person to complete analyses of such large databases, FHM constructed a computer infrastructure known as the supercomputing headhouse, and developed procedures and written code to process landcover maps with tens of billions of pixels in an extremely efficient fashion. If national fragmentation statistics can be easily localized then it may be possible to easily develop hierarchical applications to assess fragmentation at multiple spatial scales.

Inventory and Monitoring



Highway systems distribution across the United States.
USDA Forest Service

FHM has been cooperating with EPA scientists for several years on water quality issues and analyses and has co-authored several papers in FY03 as a result of that effort. All of the above research and applications are continuing, and ability to measure and assess landcover patterns is bound to improve as newer, higher-resolution data sets become available in the next several years. Developing modeling applications

Road construction contributes to fragmentation near forest lands. S. Jackson



cooperatively with France and Italy may provide international standards for comparison of multinational fragmentation statistics.

Another report by FHM shows that although forests in our nation are still connected over large regions, fragmentation is pervasive enough to potentially affect the ecological processes on most of these lands. In an article in the December issue of *Ecosystems*, researchers from FHM and the EPA used high-resolution land cover maps derived from satellite images to model forest fragmentation across the continental United States.

The study found that overall, 43.5 percent of our nation's forest was within 90 meters (295 feet) of forest edge, and almost 62 percent was within 150 meters (492 feet) of the edge. Less than 1 percent was more than 1230 meters (4036 feet) from the forest edge. Yet the study also found that where forest existed, it was dominant; 73 percent of all forest was in landscapes that were at least 60 percent forested. About half the fragmentation consisted of small (less than 7.29 ha) gaps in interior forest areas.

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The findings show that forest fragmentation is extensive, with three-fourths of all forest found in or near the edges of large, heavily fragmented regional forests. Most of the large interior forests in the nation are publicly owned, or are unsuitable for agriculture or urban development. Historic patterns of forest clearing have left relatively little interior forest along many of the major rivers, near urban areas, or in fertile agricultural areas.

Fragmentation affects habitat quality for mammal, reptile, bird, and amphibian species found in forests. Some species are adapted to edge or other disturbed habitats, but changes in forest spatial patterns more often result in negative effects on habitat suitability and the ability of wildlife to move through the landscape—and in the spread of invasive species from disturbed edges. Even small perforations introduce these impacts deeper into the forest.

Forest fragmentation serves as an integrating stress vector for dispersing nonnative exotics, insects, and disease. This, clearly illustrated by the potential for road impacts on forests, is significant because 1/5 of the total forestland area of the conterminous United States is within about 125 meters of the nearest road.

Ecological impacts from roads may be the rule rather than the exception for most of the country, according to Forest Service research. For an article in the April issue of *Frontiers in Ecology and the Environment*, one FHM researcher from Research Triangle Park, NC, teamed up with an EPA scientist to measure how close U.S. land is to the road.

To analyze nearness of roads at the regional scale, researchers used four different maps of land cover, roads, watersheds, and ecoregions. After converting the road map to generate a road-distance grid, they prepared data summaries by overlaying the road-distance grid with the other three maps and tabulating road distances by landcover type, watershed, or ecoregion. The researchers made separate estimates for total land area and for forest land area, in recognition that roads play a key role in forest fragmentation in this Nation.

Results showed that 20 percent of all land area was located within 127 meters (417 feet) of the nearest road, and 50 percent was within 382 meters (1253 feet). Only 18 percent of U.S. land area was more than 1000 meters (0.6 mile) from a road, and only 3 percent was more than 5000 meters (3.1 miles) away. Overall, forest land was slightly more remote than other land cover types, but the data followed similar trends. Results from this research were published in *The State of the Nation's Ecosystem*, the environmental study recently released by the Heinz Center for Science, Economics and the Environment.

Through intensive site monitoring research, based on crosscutting analyses at multiple-spatial scales, multiple resources, multiple disciplines, and multi-agency cooperation, FHM utilizes information to analyze forest health and the chemical and biological integrity of aquatic systems; air pollution, soil acidity, loss of calcium, and tree condition; exotic invasive hemlock wooly adelgid and forest and aquatic health; urbanization, forest health, exotic invasive plant species, and water quality and quantity; and net primary productivity and carbon budgets.

The intensive site-monitoring approaches are further nested and linked within the larger landscape scale sampling, so that process-level information from research sites (Long Term Ecological Research sites and Research Natural Areas) can be spatially and/or statistically linked to larger geographical areas. FHM has improved methods of linking forest ecosystem health with the condition of associated aquatic ecosystems [sampling first order aquatic systems with associated FIA (P2) or FHM (P3) plots] and urban and agricultural systems through relationships with forest fragmentation. FHM is providing proof of the Council on Environment and Natural Resources concept by demonstrating the efficiency of sampling at multiple spatial scales and cooperation of multiple disciplines and agencies to address multiple environmental issues in a focused and efficient manner.

Developing quantitative relationships between macro-indicators will greatly improve our ability to set ecological thresholds for interpreting

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forest condition, recent changes, and future estimates of condition at large spatial scales. This monitoring system technology will be exportable to other forest ecosystems in the United States and other countries, especially those currently using the FHM technology to monitor forest health (central Europe countries and Indonesia). The new system will also serve as a template for cross-resource inventory and monitoring by multidisciplinary teams from different groups within the Forest Service and external agencies.

Monitoring programs like FIA and FHM have quantitative relationships between large regional indicators and associated processes that will enable them to better interpret existing monitoring data and to make better risk analyses of future condition. This same information also provides better information for RPA and sustainability reports. The Southern Global Change Program uses first-time estimates of the carbon in a large area that can be compared to estimates gained from FIA (P2) for the same area. Other agencies also benefit from the approach and information obtained.

FHM monitors ground level ozone, an air pollutant in the lower atmosphere formed from the reactions of hydrocarbons and nitrous oxides in the presence of sunlight. Biomonitoring examines the impact of ozone on our forest resource by using bioindicator plants to detect and quantify ozone stress in the forest environment. Bioindicators are plants that exhibit a visible response to ozone pollution. A useful bioindicator plant may be a tree, a woody shrub, or a nonwoody herb species. A nationwide network of ozone biomonitoring sites has been established across the forested landscape. Each year these sites are evaluated for the amount and severity of ozone injury on sensitive plants. The airborne transport of ozone to remote forested areas has led to

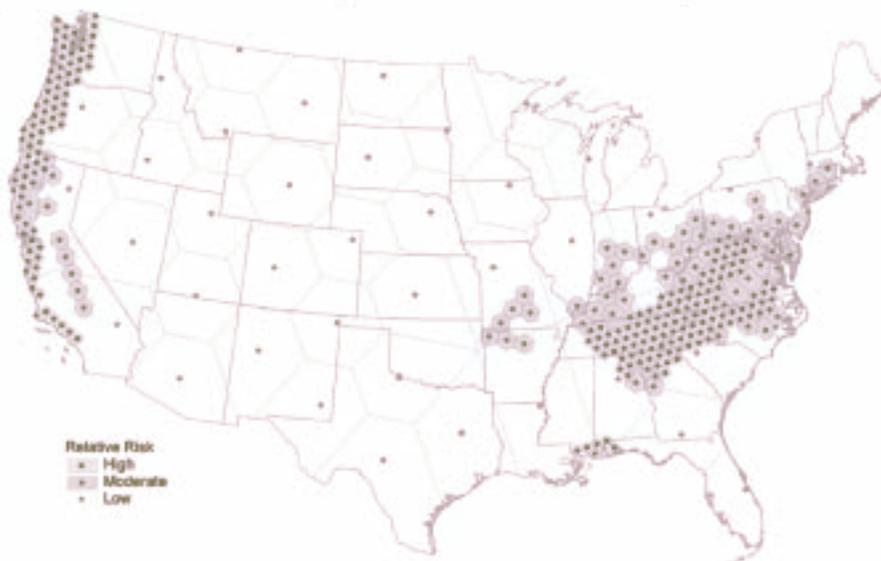
Risk map developed for surveying encroachment of sudden oak death.

USDA Forest Service

increasing concern about how this pollutant is influencing the health of the national forests. Possible impacts of ozone on forested species include reduced growth and seed production and increased susceptibility to insects and disease. The foliar injury data is used to monitor changes in relative air quality over time and to examine relationships between ozone stress and tree health.

Another application of the FIA/FHM data systems is rapid detection monitoring, or detecting the presence of exotic insects and diseases that are either localized or have likely been introduced but not detected prior to becoming widespread. A scientist from the Forest Health Monitoring unit developed national sampling design for the detection of sudden oak death (SOD), a newly identified forest disease caused by the pathogen *Phytophthora ramorum*, that has been killing thousands of tanoak and oaks and infecting shrub species such as rhododendron and evergreen huckleberry in coastal areas of California and Oregon. Laboratory investigations indicate that other oak species, including northern red and pin oak, are susceptible to the pathogen as well. The fungus that causes sudden oak death was, until recently, only found only in shrubs in the Netherlands, the United Kingdom (UK) and several other countries in Europe. Recently however, it has been found on mature northern red oak and southern red oaks, trees native to the

Preliminary SOD Risk/Hazard Map



Inventory and Monitoring



United States that were planted in the United Kingdom and the Netherlands, indicating their susceptibility to the disease beyond the seedling stage as was the case in the inoculation studies.

Concerns regarding the potential economic risk (monetary and social impact) of this disease to the Nation's oak forests have led to the development of a national SOD detection survey of forests through the FHM program. Due to the success in developing the ozone monitoring design the scientist was requested by the National SOD Survey Protocol Development Team to develop a risk hazard map as well as a sampling frame to detect the presence of a new invasive species. This allows participating agencies to maximize limited resources by focusing the initial detection surveys in high-risk areas.

Researchers are developing a risk-based survey approach similar to those used by the FHM program for ozone biomonitoring and for early detection of SOD disease. The request to provide technical support to rapid detection monitoring of exotic insects and diseases led to the initial application of the procedure to develop a risk map for sudden oak death. The goal of Rapid Detection Monitoring is to find of exotic pests before they become established. In the case of SOD, scientists developed a tree host distribution by aggregating data from FIA P2/P3 plots and

NFS CVS plots. The only national database available was from The Nature Conservancy's NatureServe database based on ecological associations. After obtaining a representative map of rhododendron nurseries from the Rhododendron Society Web page, climate data was surveyed from the PRISM data spatially interpolated from the National Oceanic and Atmospheric Agency (NOAA) weather monitoring stations. Currently, SRS researchers are participating in the development of a risk-hazard approach to detect other invasive species, including the emerald ash borer, a new threat to urban and native forests. The acceptance of the process illustrates the importance of being innovative in obtaining information, having the capacity to gain insight through interaction with scientists from other disciplines, and understanding at what measurement scale analysis is rational. Factors used to develop the risk hazard map were: (1) the distribution of known and suspected host species; (2) likely pathways of introduction to new areas; and (3) climatic conditions that favor or limit the development of the pathogen. Risk was determined by the spatial intersection of the three factors identifying regions of high, moderate, and low risk.

This approach allows the participating agencies to focus the initial detection surveys in high-risk



Other Federal agencies have also adopted risk hazard mapping to monitor host plants such as rhododendron for disease.

Inventory and Monitoring

areas in order to maximize the efficiency of the limited resources available. The risk hazard map has also been adopted by the Animal and Plant Health Inspection Service (APHIS) for a national survey of rhododendron nurseries and for a Risk Mitigation Analysis of SOD, used by APHIS as one of the critical pieces of information. The FHM researchers also work with the Forest Service Southern Region's Forest Health Protection unit in creating the sampling plan for the multi-State pilots. The risk-based monitoring methods created in FHM are also being used in several other national monitoring efforts. This approach to detection of new invasive species will allow participating agencies to maximize limited resources by focusing the initial detection surveys in high-risk areas. Risk hazard maps to guide monitoring efforts are being planned by Forest Health Protection and Research and Development for five newly-established invasive species. ▲



Hemlock woolly adelgid is one of the most important nonnative pests being monitored in the Southern Appalachians. University of Georgia, Athens

Other Significant Accomplishments

- ▶ Cooperated with the National Council for Air and Stream Improvement (NCASI), to distribute a Request for Proposals (RFP) titled *Habitat Modeling for the USDA Forest Service's Forest Inventory and Analysis Program*. To date, eight proposals have been received and two have been funded.
- ▶ Published three State Timber Product Output (TPO) Assessments, the Southern Pulpwood Production report for 2001, and a Southern Regional TPO Assessment for 1999. In addition to the reports two utilization studies were completed and processed for Virginia and Texas.

- ▶ Continued integration of the FIA and FHM detection monitoring programs was evident by the inclusion of Phase 3 plot variables into the field data recorder program (NaTally).
- ▶ Completed a pilot study under a cooperative agreement with the University of Tennessee, of the Phase 3 vegetation diversity and structure indicator on Phase 3 plots in South Carolina, which included an analysis of the pilot along with a report detailing the findings.
- ▶ Helped develop a plan and participated in a regional Phase 3 pre-training session in South Carolina, followed by four separate Phase 3 training sessions across the region for eleven States.
- ▶ Conducted six separate training sessions for the Phase 3 Ozone indicator throughout the region in FY 2003.
- ▶ Paved the way for nationally consistent estimation and processing procedures with a nationally consistent sampling design. In FY03, members of Forest Health Monitoring work unit continued to collaborate with FIA statisticians to develop nationally consistent estimation procedures. This effort resulted in the Forest Service Research Paper *Forest Inventory and Analysis National Sample Design and Estimation Procedures*, which has recently been revised due to external review.

- ▶ Devised new methods and models to estimate mean crown diameter using data collected on FIA Phase 3 (FHM) plots. These models are used by individual tree and stand modelers as well as remote sensing scientists to estimate canopy closer. A research paper, *Comparison of Field Methods and Models to Estimate Mean Crown Diameter*, has been published. ▲

Awards

Bernard Parresol received the Chief's Global Stewardship Award for outstanding work with the People's Republic of China, Mexico, Portugal, and Spain and for helping to host the International Wetlands Symposium in China. ▲





Wetlands, Bottomlands, and Streams

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Cottonwood and Oak Grow Together in the Lower Mississippi Alluvial Valley

The Lower Mississippi Alluvial Valley (LMAV) comprises 25 million acres, stretching from Cairo, IL to New Orleans, on both sides of the river. Federal and State programs offer economic options to encourage conversion of agricultural lands to woodlands. A landowner can enroll in a conservation program with a specific land management plan. Some programs can provide an annual income stream. Planting long-lived oaks between rows of fast-growing cottonwoods can generate beneficial financial results for the landowner while enriching the LMAV ecosystem.

Regeneration of bottomland hardwood species, a fundamental yet poorly understood ecosystem process, influences other ecosystem functions. Scientists installed field experiments to contrast tree regeneration success and seedling physiology under continuous canopies, in canopy gaps, and under clearcut and partially cut conditions. Results suggest the most effective way to regenerate ecologically and economically desirable tree species in bottomlands is by allowing regeneration to occur in canopy gaps or in partially cut stands. Weed management allows cottonwoods to grow rapidly, providing partial canopy and filtered sunlight for the oaks. This allows some height growth and extensive development of a root system. Spacing the oaks—red oak is a favored species—among the cottonwoods encourages the oaks to grow straight with a larger bole.

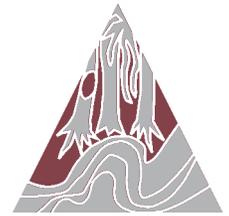
Cottonwood can be harvested for pulpwood after 15 years, providing income for the landowner and growing room for the developing oaks. Cottonwood coppice sprouts will shoot up rapidly to again provide partial canopy cover for

Black willow grows as a pioneer species in Mississippi bottomland hardwoods.

USDA Forest Service



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A cottonwood plantation can provide a fast-growing pulpwood crop and shelter young oaks.

USDA Forest Service

the oaks. The cottonwood harvest provides an opportunity to introduce more hardwood species such as green ash and pecan. Another cottonwood harvest can be taken at 30 years. In addition to generating income with cottonwood harvests, landowners can earn revenue by leasing their land for recreational purposes such as hunting. ▲

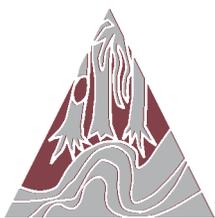
Tropical Tree Seed Manual Blooms in Full Color

The *Tropical Tree Seed Manual*, Agriculture Handbook 721, covers tree species found in all of tropical America from Canada to Colombia. Since work on the project began in April 1996, 63 scientists from 19 countries have contributed by providing species descriptions, chapters, translations, drawings, herbarium specimens, and references both published and unpublished.



The Lower Mississippi Alluvial Valley extends over 25 million acres in seven States. Private ownership accounts for 93 percent of the land.

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The *Tropical Tree Seed Manual* includes technical chapters and species descriptions. The publication contributes to academic and scientific communities by collating and organizing internationally significant research and practical data into one volume. A Spanish edition is being produced. The depth of detail provided in technical information, descriptions, and illustrations make the *Tropical Tree Seed Manual* a valuable asset for students, technicians, and scientists. The photographs show the stark beauty of seeds and the glorious color of tropical blooms. ▲

Endangered Mussels Act as Habitat Indicators

The Southeastern United States supports the most diverse freshwater mussel fauna on Earth. This fauna also is distinguished as one of the most endangered groups of organisms in North America. The Tombigbee River Basin drains approximately 6,100 square miles of northeastern Mississippi and part of western Alabama. The basin covers all or parts of 19 counties in Mississippi, reaching 190 miles in length and 48 miles in width. More mussel species live in the Tombigbee Basin than on the entire continent of Europe. Mussel harvests play a significant economic role in several Southeastern States. Filter-feeding mussels act as indicators of water quality and habitat degradation. Many mussel species found only in the Tombigbee River Basin are critically imperiled, making conservation efforts urgent. The Nature Conservancy invited the Station to work on the Upper Tombigbee Watershed Conservation Team. In workshops across the Southeastern United States, team members identified top priority conservation sites in northeastern Mississippi. The Station's expertise in the biological significance of freshwater aquatic systems and mussels in particular raised these issues to a level of prominence for conservation efforts. ▲

Mississippi Natural Resource Initiative

The Southern Research Station and the Southern Region of the Forest Service joined with The Nature Conservancy, other Federal and State agencies, nongovernmental organizations, business and industry groups, and community leaders to form the Mississippi Natural Resource Initiative. Thirty entities collaborate to implement environmentally sustainable economic development projects that focus on natural resources in Northern Mississippi. Natural Resource Initiative cooperators with diverse missions and membership work to protect natural resources for their intrinsic value and promote their use as nonconsumptive economic drivers. One completed project brings hikers and bird watchers to a new trail on the Holly Springs National Forest. ▲

Carbon Pools in Northern Coniferous Swamp Recover to Post-disturbance Levels

Sustainable site productivity depends on the maintenance of soil nutrients and organic matter. Scientists initiated a study in 1988 to assess the effects of various intensities of harvesting (clear cutting) and site preparation (disk trenching and bedding) on soil properties and ecosystem productivity. Post-harvest measurements indicate the soil carbon pools were reduced by approximately 30 percent, mostly attributable to oxidation of the forest floor. Remeasurement of the site 11 years after disturbance documents that the soil carbon pools have recovered to the same levels as the 80 year-old reference stand. Recovery of soil organic matter is related to inputs from bryophytes and shrubs, and, to a much lesser degree, the regenerated stand. The research also describes changes in the vegetation community. It has been assumed that forested wetlands recover very slowly from disturbance regimes. Results indicate that northern swamps can be quite resilient with respect to soil carbon dynamics, demonstrating that these sites can be managed sustainably. ▲

Wetlands, Bottomlands, and Streams

Constructed Wetland Owners Can Benefit from Risk-Assessment Technology

Wetland owners bear responsibility for both the operational performance of treatment wetlands and the health of animals that utilize them. Selenium-laden wastewater can pose an environmental hazard to wildlife. Even if wetlands were not created with the intent of providing wildlife habitat, legal responsibility for toxic hazards resides with the owner. In considering this type of treatment technology, the owner needs to document the selenium content of the wastewater, understand how it cycles and accumulates in the environment, and evaluate the threat it may pose to fish and wildlife. A risk-assessment technique provides a method for characterizing proposed treatment wetlands with respect to wildlife use, selenium contamination, and possible biological impacts. The technique can be applied across all habitat types and environmental conditions. The technique can reveal potential ecological problems and the associated regulatory liabilities to the wetland owner, and form the basis for selection of an environmentally sound treatment option.

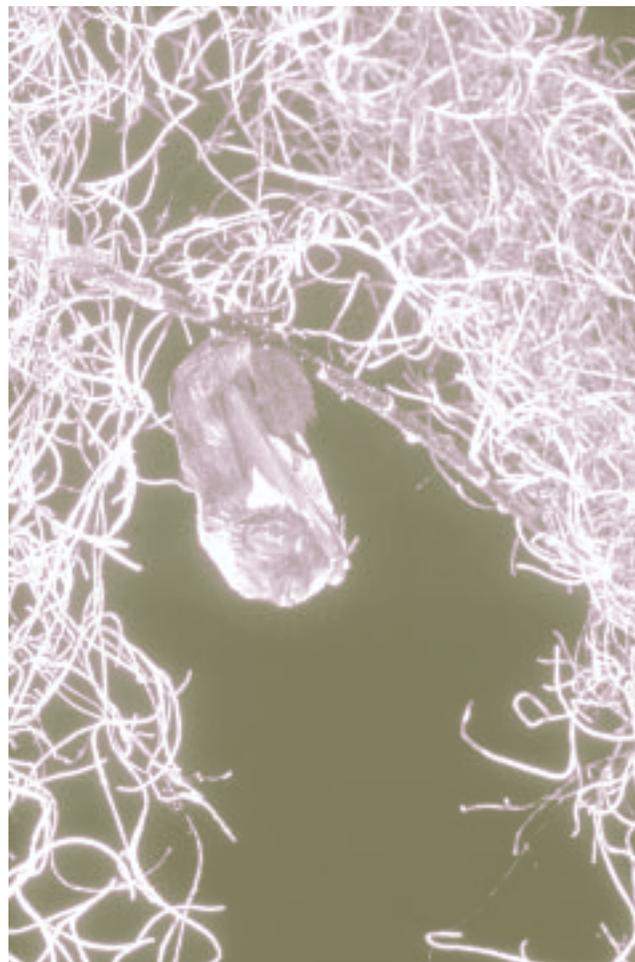
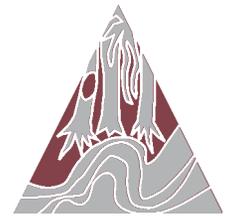
The risk-assessment technology for selenium-laden wastewater can be applied to private sector industries such as petrochemical, mining, and agriculture, as well as numerous Federal, State, and local agencies that deal with water quality management. More than 50 agencies and industries in the United States have expressed interest in the technology, and 35 countries have sought advice on applying this technique to selenium pollution issues. ▲

Bats Intrigue People and Prey on Insects

Bats stir emotions—shivers from those who fear them, awe when a female opens her wings to reveal young, fascination as they swoop to swallow mosquitoes on a humid summer night. Increasing need for conservation and interest from the general public prompted researchers to gather information about the nine species that populate the Savannah River Site, New Ellenton, SC, a Department of Energy site managed by the

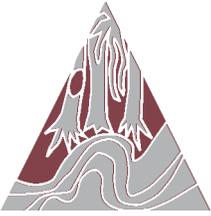
Forest Service. Bats' structure and form vary drastically from birds that fly and mammals that do not. Getting a visual fix requires a second and third look, difficult to manage with a nocturnal animal that roosts in crevices, caves, tree cavities, and other tucked-away places. *Bats of the Savannah River Site and Vicinity* fills the visual need with photographs of bats in native habitats sometimes as intriguing as the animals themselves.

Earlier research at the Savannah River Site resulted in a large dataset on bats that formed the basis for a project that includes assessments of how bats use major vegetation types; conservation and public health issues; identification keys; and accounts of 14 species, nine of which occur commonly on the Savannah River Site, plus five species that occur occasionally on the Site or occur in adjacent areas. *Bats of the Savannah River Site and Vicinity* includes accounts of morphology and distribution; roosting ecology; foraging behavior, diet, and home range; effect of



Surrounded by Spanish moss, a Seminole bat hangs from a branch. J. Scott Altenbach

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habitat type and stand age on flight activity; and reproduction. The State of South Carolina lists the southeastern myotis (*Myotis austroriparius*) and Rafinesque’s big-eared bat (*Corynorhinus rafinesquii*) as threatened and endangered, respectively. Other bats that occur regularly at the Savannah River Site include the eastern pipistrelle (*Pipistrellus subflavus*), evening bat (*Nycticeius humeralis*), silver-haired bat (*Lasionycteris noctivagans*), eastern red bat (*Lasiurus borealis*), Seminole bat (*L. seminolus*), hoary bat (*L. cinereus*), and big brown bat (*Eptesicus fuscus*). *Bats of the Savannah River Site and Vicinity* provides information needed to manage bats in a complex and changing landscape. ▲

Other Significant Accomplishments

► Plant physiologist Jack Vozzo visited Afghanistan twice to provide advice and study the problems of seed production. He continues to work on an international effort to restore habitat. ▲

Awards

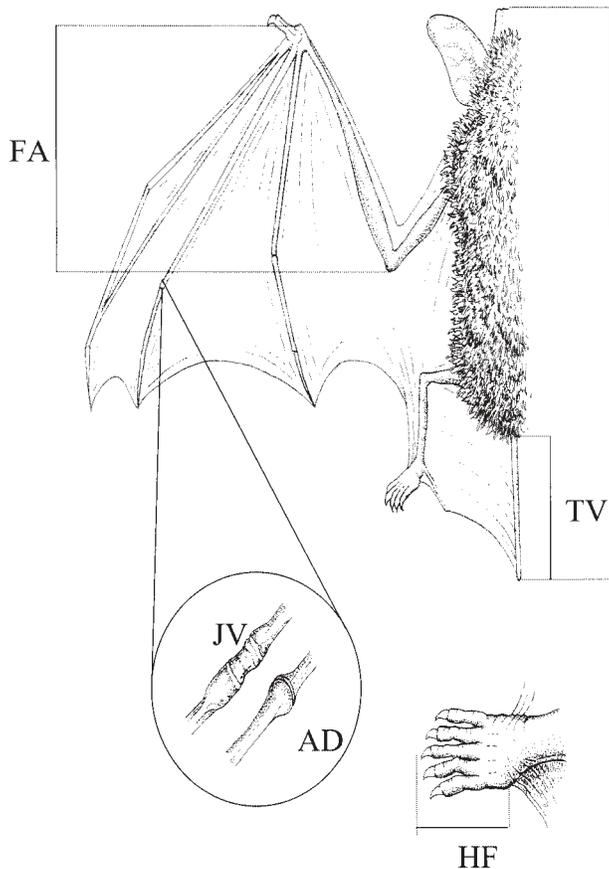
Carl Trettin received a USDI Geological Survey Recognition Award for developing an excellent international symposium on the ecology and management of forested wetlands.

Harbin Li received a USDI Geological Survey Recognition Award for effectiveness in facilitating the international symposium on the ecology and management of forested wetlands.

M. L. Warren received a Rise to the Future Award for Professional Excellence in Research.

Ted Leininger received the Delta Council Achievement Award for outstanding contributions to bottomland hardwood forestry.

Emile Gardiner received an IUFRO Certificate of Appreciation for outstanding contributions to the success of the International Conference on Restoration of Boreal and Temperate Forests. ▲



- Standard body measurements on a bat
- TL total length
 - TV tail length
 - FA forearm length
 - HF foot length
 - AD adult joints
 - JV juvenile joints

Illustration courtesy of B. Coslick

Mountain and Highland Ecosystems



Effects of Roads on Water Quality

Sediment—soil or rock material carried by water—is a major pollutant in streams in the southeastern United States. Sediment can smother the aquatic organisms fish feed on and adversely affects water quality. The main source of the sediment in the streams of the Southern Appalachian region is roads; road surfaces vary widely, from poorly maintained dirt roads to paved highways.

Best management practices (BMPs) for watersheds are practical means for reducing runoff from nonpoint sources such as roads. Examples are sediment fences, diversion walls, settling basins, and road designs that divert drainage water away from streams. Even though a range of BMPs have been developed to cut down on the sediment produced and moved from roads, it is often not clear which one should be applied in a given situation or how effective the practices actually are. Land managers need better information and tools to determine potential sediment loads from different road conditions and methods to choose the best BMPs for each situation.

For a recently completed study, researchers at the Coweeta Hydrologic Laboratory measured sediment production from four different types of road surface: paved, gravel with routine maintenance, gravel with BMPs, and poorly constructed roads with little maintenance. They found that the paved roads produced the least sediment, while the poorly constructed roads generated the most sediment. BMPs were effective in reducing sediment delivery to streams. Data from the study have been used to develop computer models that land managers now use to estimate current sediment yield from roads and evaluate how improving road surfaces—either by paving or installing BMPs—would impact future sediment production. ▲

Sediment from unpaved forest roads can be reduced by the effective use of best management practices (BMPs).

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Successes—Our Major Accomplishments



Protecting riparian zones is essential for ensuring water quality. USDA Forest Service

The Role of Riparian Zones

The health of lands lying along forest streams and rivers — often referred to as “riparian zones”— is essential for ensuring water quality in the Southern Appalachian region. Riparian zones act as filters for the nutrients and sediments that flow from upland areas, and serve as habitat for both aquatic and terrestrial organisms.

Even though every State in the Southern Appalachian region has developed guidelines specifying that streamside management zones (SMZs) be left along streams, there is no accepted standard width for these zones. The SMZs are designated to protect riparian areas and the services they provide. How wide SMZs need to be depends on the function of concern; the width required to filter sediments and nutrients may be very different from that required for shading streams, wildlife habitat, or travel routes. Most States permit some level of timber harvesting within SMZs; again, there is little research on how much timber should be left to protect water quality and other riparian functions.

The Coldwater Streams and Trout Habitat unit is working with the timber industry in Virginia and West Virginia to develop guidelines for managers on how to design effective SMZs to protect riparian functions. Researchers have

documented the vegetative composition, soil and sediment features, timber inventory, water chemistry, benthic invertebrate communities, and other characteristics of riparian areas along streams in 20 headwater watersheds in each of the two States. They have also determined the economic costs and benefits of various timber removal strategies. Further studies on the biological and water quality effects of the different SMZ treatments will help managers of timber and other operations prevent undesired effects such as erosion, loss of habitat, and degradation of water quality. ▲

Rhododendron Invasions

Riparian zones in the forests of the Southern Appalachian region are often overgrown with thickets of rhododendron. Rhododendron is a tough, acid-loving shrub that easily invades areas that have been disturbed by natural events such as hurricanes and ice storms. Studies suggest that rhododendron thickets, which shade out other native plants and tree seedlings, are expanding and may be affecting watershed processes. Yet there is little scientific understanding of how disturbance and rhododendron invasion affect nutrient filtering in riparian zones, and little guidance to land managers on how to manage these areas.

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Long-term research at Coweeta Hydrologic Laboratory includes a study of the impacts of Hurricane Opal, which pushed through the Coweeta basin in 1995. Researchers used the opportunity Opal offered to study the effect of felling large trees and rhododendron thickets on nutrient movement and stream quality. Results of the study showed that the removal of rhododendron had very little effect on nutrient movement and no effect on water quality. In contrast, the uprooting of trees and subsequent soil disturbance resulted in large and persistent increases in streamwater nutrients, especially stream nitrate nitrogen, a sensitive indicator of disruption in the ability of the stream to filter nutrients. The research indicates that, to sustain water quality, managers should minimize activities in the riparian zone that cause large amounts of soil disturbance. ▲

Reconciling Recreation Use with Research Needs

Conflict among competing recreational uses is one of the pressing issues national forest land managers face, but conflict between recreational use and forest research has been relatively limited. This year, the Southern Appalachian Ecology and Management unit responded to concerns from recreational users by revising a research proposal for part of the Bent Creek Experimental Forest.

Located just outside Asheville, NC, the Bent Creek Experimental Forest is one of the oldest research forests in the United States. The Experimental Forest's 39 miles of designated trails have become a popular destination for walking, hiking, and mountain biking. The Experimental Forest is also the site of long-term experiments by SRS researchers on how to manage the forests of the coves and slopes typical of the Southern Appalachian region. Next year, the unit will complete the first five years of a long-term study comparing fruit and mast production in mature and recently harvested hardwood forests. These silvicultural experiments also serve as demonstrations for the many forestry students and practitioners who study in the Experimental Forest each year.

In May 2003, the Forest Service issued a research proposal for the Experimental Forest that would have converted sections of the popular mountain bike trails into gravel roads to provide needed access to research areas. People using the Bent Creek trails, especially mountain bikers, immediately expressed their concerns about the reduction in trail access proposed in the plan.

In response to concerns, SRS researchers withdrew the initial plan and worked with local cycle clubs to come up with an alternative that reduces the number of miles affected to three



Mountain biker at Bent Creek Experimental Forest. B. Lea

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out of the total 39, and restores most of the roads to their present condition when the research activities are completed. Only one section of trail, a little over a mile, would be permanently changed to a road. This road will be used to drive study tours to demonstration sites, and though closed to public vehicle use, will continue to be part of the mountain bike trail system in Bent Creek. ▲

Managing Forests for Species Richness

Silviculture treatments involve cutting out certain sizes or species of trees to affect the density or composition of a forest stand. One of the goals of forest management is to promote or maintain the diversity of organisms—species richness—within a forest. Species richness can be affected by conditions at the ground level, such as light availability or the thickness of leaf litter, that are governed by the density of the forest canopy.

Research foresters from the Bent Creek unit are manipulating 10-acre oak-hickory stands in northern Alabama to find out how different levels of canopy tree retention affect species composition, with oak selected to increase in proportion to other canopy tree species. Preliminary findings show that 25 to 50 percent retention treatments increase the number of oaks when oaks are the favored leave trees. New growth is being closely monitored on the stands; the data will be used to help develop a model to predict regeneration in oak-hickory settings.

Three graduate students from Alabama A&M are using these stand treatments as the basis of their research on species richness. One student is looking at the number of breeding bird species in relationship to forest treatments. Another student is focusing on how the physical habitat produced by different treatments affects amphibian and reptile populations. The first year after the forest treatments, results from the studies showed the maximum species richness for breeding birds in the 25 percent treatment, while species richness of reptiles and amphibians combined were highest in the 50 percent treatment.

SRS researchers list data collected from bats captured in mist nets. Z. Hoyle



Alabama A&M graduate student is growing red oak seedlings under full sun and shaded conditions to test their survival rates. USDA Forest Service

A third student is working on artificial oak regeneration, growing northern oak seedlings in the greenhouse under two different light regimes and then transplanting them to the clearcut (100 percent) and 75 percent retention treatments to look at seedling growth and survival. ▲

Effects of Management on Forest Bats

Because of their small size, long life spans, and low reproductive rates, bats are highly sensitive to



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human disturbance. Almost half of the bats found in the South are considered to be endangered or species of special concern. Although the number and diversity of bats present can be an indicator of the health of a forest, very little research has been done on the effects of forest management on bats.

Bats are primarily nocturnal creatures and rely on echolocation, using their own high-pitched calls to navigate in the dark and to find their prey. Young, dense forests are mechanically and acoustically cluttered, and may not be suitable habitat for many forest bat species. Forest management practices that decrease clutter may increase the suitability of forest stands for bats.

Researchers at the Endangered, Threatened, and Sensitive Species unit, Clemson, SC in collaboration with the Disturbance and Management of Southern Ecosystems unit, Athens, GA and Clemson University, are studying the effects of forest management practices on bat habitat use and activity. Using study plots established on the Clemson Experimental Forest for the national fire and fire-surrogate study, wildlife biologists are testing whether thinning and prescribed burning, two practices commonly applied to increase tree growth and reduce the risk of wildfire, also increase habitat suitability for bats.

Bat detectors were placed in the treatment stands for two summers, and researchers periodically captured bats near the test plots. Red bats, big brown bats, eastern pipistrelles,

Evening bat. J. MacGregor



and evening bats were the most common species captured; additional species captured included the silver-haired bat and the Seminole bat.

Researchers found more bat activity in the treated plots than in control plots that had not been thinned or burned. These findings suggest that forest management practices that open the canopy and midstory can increase the suitability of forest stands for bat foraging and commuting. ▲



Ramps in early spring. D. White

Monitoring Ramp Populations

Residents of the Southern Appalachians have been harvesting “ramps,” also known as wild leeks (*Allium tricoccum*), for generations. Native Americans probably taught early European settlers to gather ramps. Gatherings with cooking and music formed around the spring collection of ramps, the first fresh vegetable to emerge in the spring. Over the past few decades, these gatherings have evolved into annual festivals that serve as major fundraisers for rural fire departments and other community organizations.

Ramps grow in shaded forests, and most of the plants collected for festivals and private use come from National Forest System land. In the past few years, ramp festivals have grown in popularity. Surveys done by a researcher from the Integrated Life Cycle of Wood unit, Blacksburg, VA, show that major groups use 500 to 600 pounds of ramps per festival, with between 40 and 80 bulbs making up a pound. National forest managers have raised concerns about the effects of these harvests on ramp populations.



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Harvested ramps. D. White

In cooperation with national forest botanists, the Endangered, Threatened and Sensitive Species unit started gathering baseline data to develop a monitoring plan by measuring the density and cover of ramps in 21 natural populations in the upper Nantahala River watershed of North Carolina, where much of the ramp festival harvesting is done. In FY03, the unit completed five years of sampling, the first phase of data collection needed for assessing the effectiveness of the monitoring design.

Ramp populations varied among years, with some years having greater abundance than others, even without harvest. SRS researchers have just started analyzing plot data, but they are already seeing wide variation in density and cover among



Harvesting ramps is a long-time tradition in the Southern Appalachian region.

D. White

the plots. Since the year to year variations among all plots were similar, the findings suggest that underlying climate factors such as rainfall may affect the extent of ramp populations from year to year.

Several SRS units are collaborating to gather the information that the national forests in the Southern Appalachian region need to develop a policy for the sustainable management of this culturally and economically valuable forest plant. Areas of research include the socioeconomic aspects of harvest, ramp distribution and abundance, and habitat modeling. ▲

New Facilities for the Coweeta Hydrological Laboratory

During FY03, the Coweeta Hydrological Laboratory finished renovating their Analytical Laboratory, built a new conference center, and refitted their onsite residence for visiting scientists. The Analytical Lab, which every year generates 63,000 chemical determinations for both experimental and long-term monitoring projects, now includes additional analytical space, a walk-in drying oven and cooler, and state-of-the-art safety features.

The new conference center includes indoor and outdoor meeting areas and eight offices and supporting facilities. The 6400 square foot center is designed for both formal and informal meetings. The 80-person conference room can be arranged for a variety of purposes, and the living room with its large fireplace and the large hallways provide areas for informal networking. The outside walls of the conference center are primarily floor-to-ceiling windows that carry the eye to the unique natural setting of the Coweeta Hydrologic Laboratory.

Renovations of the Coweeta residence were also completed this year. Part of the residence is the original Coweeta Headquarters Building constructed in 1937 by the Civilian Conservation Corps. The recent expansion of the residence, which was designed to match the original architecture as closely as possible, includes a complete renovation of the interior and the installation of computers in every room with

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high-speed internet connections. The residence can now house 24 people at a time; approximately 50 scientists and 60 graduate students conduct research at Coweeta each year, with annual overnight stays of over 2000.

The expansions and renovations at Coweeta resulted from cost-shared funding from the USDA Forest Service, the University of Georgia, Athens (UGA), and the National Science Foundation (NSF). Coweeta maintains a strong partnership with UGA, and is an NSF Long-Term Ecological Research site. ▲

Upgrades to the Coweeta analytical laboratory include state-of-the-art equipment. Z. Hoyle



Other Significant Accomplishments

- ▶ Continued examining the potential impacts of climate change on the distribution and population status of several species on Neotropical migratory birds in the Southern Appalachian mountains.
- ▶ Continued research on the influence of large woody debris on stream channel morphology and fish habitat in Appalachian streams. ▲

Awards

James Guldin received the Arkansas Oak Award from The Nature Conservancy in recognition of outstanding support for sustainable forestry and conservation in Arkansas. ▲



The new conference center is set within the unique watershed setting of the Coweeta Hydrologic Laboratory. Z. Hoyle



Southern Pine Ecosystems

Forest Insects and Diseases

Southern pine beetle. Throughout the South, infestations of southern pine beetle (*Dendroctonus frontalis*) have become increasingly common. High-value trees are susceptible to attacks, particularly when stressed by drought, flooding, or other damage. Losses in seed orchards, yards, parks, and elsewhere are more expensive in many ways than losses associated with commercial timber stands. Historically, preventive spraying with insecticides has been the only measure available. To date, however, there are no effective insecticides marketed for use against the southern pine beetle.

The Bark Beetle and Invasive Insects work unit in Pineville, LA, has been collaborating with university scientists and timber industry representatives to find effective treatments. They have evaluated insecticides that show promise for beetle control, and have found two to be effective for about 6 months. They have closely been studying Warrior-T[®] and Biflex[®]; a Federal label has been issued for Biflex[®]. ▲

New compound for individual tree protection. A collaborative study between the Pineville unit and the University of Georgia has identified an insecticide that is effective in protecting individual trees against southern pine beetle (and other bark beetle) attack. One application of Onyx[®] was shown to effectively protect trees for up to 6 months. This product is available to licensed applicators in many southern States. ▲

Cone beetles and eastern white pine. Recent widespread mortality of eastern white pine by the southern pine beetle has underscored the importance of maintaining healthy white pine

seed orchards, and any major restoration of white pine stands in the Southern Appalachians will require production and collection of high-quality white pine seed. The white pine cone beetle (*Conophthorus coniperda*) poses a serious threat; it can virtually destroy entire cone and seed crops within a single seed orchard.

Female beetles attack the base of second-year cones, girdling the stem, tunneling along the cone axis and laying eggs. Larvae hatch and feed within the cone, consuming most of the seeds. Scientists in Pineville have successfully used pheromone-baited traps to monitor male beetle activity in seed orchards. The new research has allowed them to focus now on identifying attractants for female beetles, as well as the white pine families that are not favorable to beetle development. This ongoing research is looking at the significant relationship of eastern white pine, cone beetles, and a certain beetle predator (*Thanasimus dubius*). Results of their studies could have implications for other systems involving bark beetles, predators, and pine trees. ▲

New bark beetle. While the southern pine beetle continues to be the most destructive insect pest in southern forests, recent outbreaks have occurred as far away as southern Arizona. Those infestations have been shown to result from southern pine beetle and the Mexican pine beetle. Pineville scientists identified the latter and confirmed its potential as an economically damaging insect in the United States. Recent and extremely damaging outbreaks have occurred in Belize and neighboring countries.



White pine cone beetles can destroy an entire cone crop.

University of Georgia, Athens

Southern Pine Ecosystems



Shortleaf pine was prominent in presettlement forests of the upland areas of Arkansas

B. Lea

Monitoring and control of such destructive insects cannot occur without accurate information about pheromones, a key focus of study in the South. The effort has been multidisciplinary and highly collaborative. Forest managers in Arizona and Central America are both partners and beneficiaries. Collaborators include the Belize Department of Forestry, Ministry of Natural Resources, as well as practitioners in Arizona and throughout the southern States. Many Pineville scientists have been invited as collaborators on other forest entomology research, and a number of them have presented their work in refereed journals and in national and international meetings. ▲

Timber-stand Dynamics and Development

Successful management of uneven-aged pine stands must take into account stand dynamics as well as disturbance. Scientists at the Upland Forest Ecosystems research work unit in Monticello, AR, have published cutting-edge

research about presettlement forests in the Upper West Gulf Coastal Plain. Such forests tended to be more open, with less woody overstory than present-day forests. Windthrow, fire, and ice storms significantly altered the landscape and contributed to the spatial heterogeneity of timber stands.

The Monticello scientists also found that there had been a prominence of shortleaf pine in presettlement forests of the upland ecosystem. Contemporary natural stands there rarely have more than 10 percent of the pine component in shortleaf, whereas presettlement pine stands probably averaged around 50 percent, and some may have had 90 percent or more. General Land Office survey notes from the early 1800s describe forests of Ashley County, AR, as having a very high level of arboreal richness. In those surveys, dozens of species were recorded as witness trees to document corners and land lines. Many such trees had remarkable dimensions, such as numerous pine, oak, gum, and baldcypress, which often were greater than 6 feet in diameter.

The Monticello lab's research provides good reference information at a time when ecosystem restoration is a key management goal. Publications resulting from these studies not only will help managers and landowners restore or modify mature pine stands, they also will be widely disseminated in forestry classes, workshops, and silvicultural training courses offered on the Crossett Experimental Forest. ▲

Restoration and Management of Longleaf Pine Ecosystems

Researchers at the Vegetation Management and Longleaf Pine research work unit in Auburn, AL, are working on several concurrent and cooperative studies that will provide the tools and technology necessary to restore and manage longleaf pine ecosystems. The studies are now yielding scientific understanding and some practical management guidelines for all components of the ecosystem.

The work is organized under three broad elements with studies associated with fire ecology, restoration strategies, and silvicultural systems, for longleaf pine ecosystems.



Southern Pine Ecosystems



Periodic use of prescribed fire, when coupled with mechanical treatment of understory vegetation, helps prevent catastrophic wildfire. USDA Forest Service

Fire ecology and ecological restoration. In a collaborative study with the Forest Operations unit, Auburn, AL, preliminary observations from a midstory reduction study at Fort Benning, GA suggest that mechanical methods are effective means for rapidly altering forest stand structure to eliminate midstory “fire ladders.” Such treatment will transform this vegetation layer into woody debris that can be safely burned without excessively endangering overstory trees. The relatively rapid regrowth of mechanically treated understory vegetation makes it necessary to periodically use prescribed fire if a stand is to maintain a generally open structure and not succumb to catastrophic wildfire. Initial findings were presented in August 2003 at the annual Ecological Society of America meeting in Savannah, GA. In September 2003, final data collection was completed and results will be published in refereed scientific journals.

In cooperation with the Disturbance and Management research unit in Athens, GA, scientists at the fire and fire-surrogates longleaf

pine study site at Myakka River State Park, FL, conducted initial studies showing that saw-palmetto (*Serenoa repens*), the principal and most dangerous understory and midstory fuel in the longleaf ecosystem, cannot be effectively reduced by fire-only treatments. It appears that at current levels the species is so prevalent in these former “wet prairies” that an ecological threshold has been crossed, and fire-only treatments create a tenuous equilibrium. The research suggests that prescribed burning must be followed by some type of mechanical treatment to achieve any substantial reduction in palmetto dominance and thus wildfire risk abatement. The frequency with which these treatment combinations must be repeated to effect lasting wildfire hazard reduction in the long term will be the subject of continuing investigation. The Auburn scientists and cooperators presented their initial findings in November 2002 at the Southern Fire Science Conference in Sarasota, FL. Post-treatment data were collected during October and November 2003 and will be published in refereed scientific journals.

Southern Pine Ecosystems

In another fire and fire-surrogates longleaf pine study site at the Solon Dixon Forestry Education Center, near Andalusia, AL, prescribed fires were successfully completed during the spring and summer of 2003. Post-treatment data collection continued through October and study findings will be presented to scientists and managers.

Silvicultural systems for longleaf pine ecosystems. In FY03, scientists from Auburn, AL, and Athens, GA, installed a new study entitled *Comparative Analysis of Silviculture Systems* on the Escambia Experimental Forest in Alabama. Study sites also will be installed on two State forests in Florida in FY04. The Florida Division of Forestry has agreed to fund this work.



Longleaf pine grows well on the Uwharrie National Forest.

B. Lea



Researcher checks a study of longleaf pine.

B. Lea

The proposed study will be an operational-scale research demonstration that comprehensively examines silvicultural methods for effectively regenerating and sustaining longleaf pine forests in perpetuity. Single-tree selection, group selection, irregular shelterwood, uniform shelterwood, and naturalistic management (no timber harvest) will be tested in a randomized complete block experimental design on the major ecological site types (flatwoods, mesic uplands, sandhills) on which longleaf pine occurs in the South. The study will provide both public and private forest managers with information crucial to the successful short-term and long-term management of longleaf pine ecosystems. ▲

Establishment and Growth of Forest Regeneration

Forest research has long recognized overstocking as a major problem in naturally regenerated loblolly and shortleaf pine stands. It reduces diameter growth, lengthening the time needed for trees to reach valuable sawtimber size, and it reduces stand health, heightening the risk from damaging agents such as fire, insects, and disease. Scientists at the Upland Forest Ecosystems lab in Monticello, AR, published 25 years of research results dealing with precommercial and commercial thinning in overstocked natural pine stands on the Crossett Experimental Forest.

The Monticello studies showed that precommercial thinning enhanced growth in both stem diameter and sawtimber volume over the long term. In addition, precommercially thinned trees had much wider and longer crowns than did those that were not thinned. Increased sawlog production made present net value greatest in stands that were precommercially thinned at 6 years and then commercially thinned at 17 and 23 years. The only stands that had substantial losses due to insect infestations were those in unthinned control plots. Research results such as these give landowners greater options in managing natural pine stands. In the last year, information on the use of thinning as a silvicultural tool was well received by several university and professional groups that toured the Crossett Experimental Forest. ▲



Southern Pine Ecosystems



Management of Forested Landscapes

Traditionally, foresters have used silvicultural treatments to change forest or woodlot conditions in order to meet landowner needs. To provide a sound basis for and a useful perspective on productive forest management, the Monticello Upland Forest Ecosystems research work unit published two manuscripts of particular note in 2003. The first was an invited chapter in a book on forest management and stewardship that can be used nationwide as a college textbook. The chapter provides a survey of forest management principles that are commonly used across stands and landscapes. It highlights several examples of landscape management, including habitat restoration in the shortleaf pine-bluestem ecosystem and research in the western Ouachita Mountains. In addition, it provides information about the national forest survey program sponsored by the Forest Service Washington Office.

The second manuscript presents a capsule view of one 2-day workshop that was held at Yale University. The workshop focused on silviculture research from the perspective of both research scientists and those who use it. This paper provides a view of future research needs and offers a perspective on basic principles, research opportunities, and an invitation to design and interpret cutting-edge studies in the field. ▲

Drought, Fire, and Wildlife

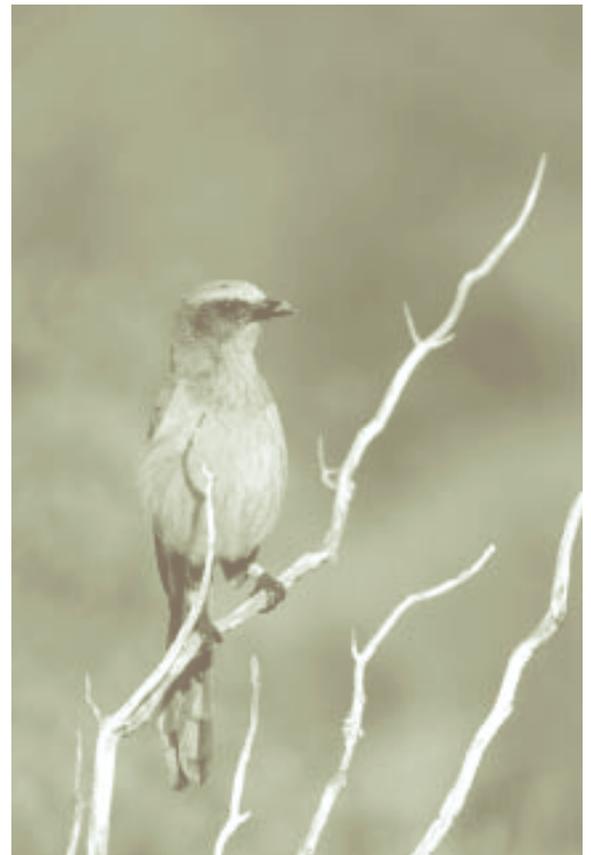
Ongoing drought in the southern States over the last several years has drawn the attention of physical, biological, and social scientists, as well as the many and varied interests who live with and depend on forest resources in the region. The scope of interest in major impacts such as drought and wildfire has provided many cross-jurisdictional opportunities. One such opportunity brought together land managers from the Ocala National Forest in Florida, and research scientists at the Wildlife Habitat and Timber Resource Integration laboratory in Nacogdoches, TX. Scientists there applied their considerable expertise to study the Florida scrub jay (*Aphelocoma coerulescens*), a Federally listed threatened species that is endemic to scrub habitat

on well-drained soils along Florida's coast and in the State's interior sand dunes.

The Ocala National Forest plays a crucial role in the recovery of this species, because it is one of three areas (including Merritt Island/Cape Canaveral and Archbold Biological Station) that must have stable or increasing populations before the species can be considered for delisting by the USDI Fish and Wildlife Service. Current information about optimal habitat conditions on the Ocala was lacking, particularly with regard to survival of young and adult birds, nesting, reproductive success, dispersal, mortality, predation, and home range. To help meet data needs, the scientists began a demographic study of this species in 2001. The data suggested that a low rate of reproductive success may be the result of nest predation, or the direct result of drought conditions. To determine if predation was a substantial factor in nest loss, they used video cameras to monitor nests in 2002 and 2003.

Station scientists have teamed up with land managers from the Ocala National Forest in Florida to study the endangered Florida scrub jay.

B. Lea



Southern Pine Ecosystems

In the 11 nests monitored, all nestlings in five of them and at least one nestling in each of two others were eaten by predators. The predators included American crow, gray fox, spotted skunk, eastern coachwhip snake, and another species of snake (probably a corn snake). The 11 nests produced 17 fledglings for a success rate of 2.83 fledglings per successful pair or 1.55 fledglings per nesting attempt.

This study's results will help biologists determine if Florida scrub-jay populations on the Ocala National Forest can withstand such a high loss of nestlings. If it is determined that the scrub-jay population cannot grow under the level of predation documented in this study, control measures may be necessary. In any case, the partnership of national forest land manager and research scientist may be key to this species' survival. ▲

Tactical Harvest Planning and Management

Resource managers and planners are working on larger and larger spatial scales. Operations at several sites may occur simultaneously—or over a long time. Regardless, strategic planning and resource allocation are becoming critical to economic and ecological success. In many cases, human and physical resources may be spread out over great distances and involve major commitments of capital and equipment. To begin work on one site may depend on the completion of work on another. Allocating resources to jobs in the wrong order may result in a waste of time and energy, missed deadlines, hurried implementation of prescriptions, and increased operating costs. Trying to effectively manage forest operations requires the acquisition, integration, manipulation, and assessment of huge amounts of information, and the development of decision-support tools has become necessary to ensure effective management.

Scientists at the Forest Operations Research work unit in Auburn, AL, have conducted a series of fundamental studies to evaluate alternative methods of gathering tree size information during various stages of management. Although methods are available for some types of forest operations,

most are not applicable to the widely used tree-length logging systems. The researchers have designed and tested direct-contact, optical sensing, and kerf-mass sensing prototypes. The optical sensing approach, using an innovative arrangement to correct for varying vehicle speed, seems the most promising. Nonetheless, they are still dealing with practical issues of equipment sensitivity to harsh environmental conditions.

Two new harvest-simulation tools are now helping managers more effectively plan operations. One model, Harvest System Assignment, compares the cost and efficiency of alternative systems in a given stand type. The second, Setting Analyst, uses spatial information to more accurately model the effects of terrain and operational layout on system performance and cost. ▲

Forest Herbicides and Water Quality

Forest managers, interest groups, and the general public have been discussing forest management and its impacts on water quality and the organisms that inhabit aquatic ecosystems for most of the last 40 years. Before now few studies focused on how forest management activities that do not use herbicides (such as harvesting and mechanical site preparation techniques), differ from forest management activities which do. In FY03, four peer-reviewed publications by scientists and their cooperators at the Vegetation Management and Longleaf Pine unit in Auburn, AL, addressed this question. The combined results of these studies indicate that impacts on aquatic ecosystems will more likely result from the choice of harvesting method or other site disturbances near headwater forest sites than from the use of two popular forest herbicides. No impacts were observed on aquatic organisms even when the herbicide application rates were 10 to 100 times above the EPA approved label rate. Thus when applied at the approved label rates, the widely used forest herbicides (sulfometuron and imazapyr) do not threaten aquatic ecosystem safety. This research has been communicated to audiences worldwide. Conference and symposium planners continue to invite the lead scientist as a guest speaker to talk about this important work. ▲



Southern Pine Ecosystems



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Successes—Our Major Accomplishments

New Tools

Resin gauge. A major shortcoming of southern pine beetle research has been the lack of a reliable, rain-proof, reusable, and economical device for sampling resin flow. Station scientists have developed a new means of measuring resin flow, which is shown to increase substantially when pines are attacked. They have devised and tested a molded plastic resin sampler and published instructions in the sampling technique, which can be used to collect and accurately measure resin from pine trees regardless of weather conditions. It is reusable, inexpensive, and a significant aid in responding to bark beetles. The device will facilitate a more efficient, economical, less labor intensive sampling of trees and allow quicker and more extensive evaluation of natural resistance within southern conifers.

Near-infrared spectroscopy. Historically, forest managers have sought to increase timber growth and yield to produce as much fiber as possible from timber stands. As technology has developed, however, practitioners are finding that accelerated growth rates may actually degrade wood quality. Such results have been hard to quantify because determining wood properties using a large dataset can be laborious and time consuming. Recently, Station scientists have made considerable progress assessing wood using spectroscopic and multivariate statistical methods, which can simultaneously determine mechanical, physical, and chemical properties. Research now underway at the Southern Forest Resource Utilization unit in Pineville, LA, will help quantify the effect of growth rate on a number of wood properties, and such information can be used by forest managers to make decisions on silvicultural prescriptions. ▲

Forest Ecosystems and Forest Operations

Soil loss and reduced site productivity resulting from forest management activities are ongoing concerns. Machines often cause soil compaction, erosion, poor air and water infiltration, oxidation of organic matter, and loss of nutrient stores. Post-harvest conditions may be improved by tillage; and the application of herbicides and fertilizers will promote stand regeneration. Scientists at the Forest Operations Research unit

in Auburn, AL, have made significant advances in assessing the extent of change in the soil environment and its variability within a given timber stand. Their research addresses a need for thorough assessment of resource capabilities. They have measured soil compaction to determine its variability within a stand under conventional and alternative management prescriptions, in order to promote adequate regeneration in both managed and natural stands. As a result of their ongoing research, results from multiple studies now are providing an opportunity to take a longer view of successes and failures.

Two studies of machine use in three areas of the Piedmont indicated consistent soil responses, and soil moisture content was influential in both bulk density and soil strength. The scientists determined that cone penetrometer data can be used as a surrogate for soil moisture determination under certain conditions; one of their studies reported how hydroperiod affected productivity and nutrient cycling in the Flint River System of Georgia. These results were comparable with results from other floodplain systems elsewhere in the Southeast and will contribute to a more comprehensive understanding of site conditions and dynamics, which can be considered before forest operations are begun. In addition, the results will be valuable in assessing soil response to forest operations in both upland and bottomland forests. ▲

Evaluating Mechanical Fuel-reduction Treatments

By all estimates, efforts responding to the now widely recognized need for forest fuel-reduction will generate large amounts of small-diameter material. One challenge land managers face is finding cost-effective methods either to remove this material from the forest or to treat it in place. There is a growing recognition of the amount of work to be done; manufacturers, managers and technicians from the natural resource agencies, and independent contractors are helping compile relevant information from a variety of sources. Within the Forest Operations Research work unit in Auburn, AL, scientists have been conducting a series of studies that address specific data needs.

Southern Pine Ecosystems



A new technology, biomass bundling, was introduced in North America in 2003.

USDA Forest Service

One provided a comprehensive review of mechanical fuel-reduction technology. The scientists studied mulching equipment and some fundamental variations in the types of machines used. One such machine is capable of grinding standing material into small pieces and leaving mulched material on the forest floor. Before this study, no information about use of that machine was available. The scientists measured production in different forests and within different soil types. They installed a long-term wildlife monitoring project in one area to see if changes in forest structure would produce changes in resident wildlife populations. Similarly, they designed long-term vegetation plots to track changes in plant communities, and another study to consider how long managers should wait between mulching and use of prescribed fire.

While mulching operations may be appropriate for treating small-diameter material in a stand, in some areas biomass has to be physically removed. Earlier studies considered conventional methods of whole-tree extraction, but a new technology known as biomass bundling was introduced in North America in 2003, and it has become the subject of ongoing evaluation and demonstration.

Six national forests in the West provided a range of test sites with different species, slash treatments, and terrain. The bundling machine, which is something like a large hay baler, collects material and compresses it on-site. The method has been shown effective and economical because the denser packages of biomass reduce handling and transportation costs. Production rates are significantly affected by residual stand density, slash volume and orientation, and terrain. The studies have identified performance issues not encountered in earlier applications conducted in Scandinavia.

The Auburn scientists' continuing research is expanding our working knowledge about all types of mechanical fuel-treatment technologies. Contractors, Forest Service managers and technicians, and manufacturers are reporting benefits, and this year the U.S. House of Representatives Subcommittee on Forest Resources welcomed two presentations of the biomass bundling project. ▲



Southern Pine Ecosystems



Other Significant Accomplishments

- ▶ Presented new measurement techniques (automated means to measure soil carbon losses, ground-penetrating radar to estimate root biomass, methodologies to qualify and quantify root carbon exudates); integrating and evaluating models that describe and predict both above- and belowground carbon cycling. Validated models allow landowners to enter simple stand measures to calculate carbon sequestration and the impacts of varying management options (such as rotation length, site preparation, fertilization, and thinning).
- ▶ Presented research results about reduced productivity resulting from short-rotation harvest, focusing on successive rotations of intensively managed loblolly and slash pine. Participated in the international Long-Term Soil Productivity program in evaluating how soil productivity is affected by intensive site preparation and harvesting.

Station researchers are developing ground penetrating radar (GPR) technology to replace traditional methods of studying tree root systems.

John Butnor, USDA Forest Service



- ▶ Used forest-projection models to integrate management techniques that reflect ecological processes and better represent forest growth under a changing environment, in response to a growing public interest in restoring longleaf pine ecosystems. Continued specific studies that provide a means of comparing the performance of longleaf with other southern pines.
- ▶ Continued research on ecological restoration and sustainable management of longleaf pine ecosystems, focusing on large-scale fire ecology, silvicultural systems, and prediction models. ▲

Awards

William Boyer was elected a Fellow in the Society of American Foresters. ▲

Appendix – *Budget and Work Units*

2003



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2003

U.S. Department
of Agriculture
Forest Service
**Southern
Research
Station**



FY03 Initial Allocations to Resource Categories

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Fundamental Plant Science	\$5,157,000
Silvicultural Applications	3,959,000
Quantitative Analysis	1,124,000
Forest and Rangeland Management	3,692,000
Forest Operations Engineering	767,000
Insects/Diseases/Exotic Weeds	5,567,000
Fire Science	1,135,000
Terrestrial Wildlife	1,413,000
Aquatic Habitat	1,016,000
Watershed	1,557,000
Atmospheric Sciences	1,376,000
Economics	1,942,000
Riparian	772,000
Social/Cultural	664,000
Urban Forestry	303,000
Forest Products, Utilization, and Processing	1,560,000
Forest Inventory and Analysis	12,204,000
Monitoring Methods/Applications	353,000
 Total	 \$44,531,000

FY03 Initial Allocations to Research Work Units

4101	Southern Appalachian Forests, <i>Asheville, NC</i>	\$1,771,000
4103	Center for Forested Wetlands, <i>Charleston, SC</i>	1,205,000
4104	Disturbance of Southern Pine Ecosystems, <i>Athens, GA</i>	1,814,000
4105	Vegetation Management and Longleaf Pine, <i>Auburn, AL</i>	1,169,000
4106	Upland Forest Ecosystems, <i>Monticello, AR</i>	1,768,000
4111	Even-aged Management of Southern Pines, <i>Pineville, LA</i>	1,639,000
4153	Southern Institute of Forest Genetics, <i>Saucier, MS</i>	1,785,000
4154	Biological Foundations of Sustainability, <i>Research Triangle Park, NC</i>	2,343,000
4155	Center for Bottomland Hardwoods, <i>Stoneville, MS</i>	3,640,000
4201	Endangered (TES) Species, <i>Clemson, SC</i>	615,000
4202	Coldwater Streams and Trout Habitat, <i>Blacksburg, VA</i>	586,000
4251	Wildlife Habitat and Timber Resource Integration, <i>Nacogdoches, TX</i>	1,125,000
4351	Watershed Responses to Disturbance, <i>Franklin, NC</i>	1,486,000
4501	Bark Beetles and Invasive Insects, <i>Pineville, LA</i>	1,004,000
4502	Wood Products Insect Research, <i>Starkville, MS</i>	1,035,000
4505	Insects and Diseases, <i>Athens, GA</i>	1,844,000
4701	Southern Forest Resource Utilization, <i>Pineville, LA</i>	1,226,000
4702	Tree Quality, Processing, and Recycling, <i>Blacksburg, VA</i>	495,000
4703	Forest Operations Research, <i>Auburn, AL</i>	1,246,000
4801	Forest Inventory and Analysis, <i>Asheville, NC, and Starkville, MS</i>	12,104,000
4802	Legal, Tax, and Economic Influences, <i>New Orleans, LA</i>	1,006,000
4803	Forest Health Monitoring, <i>Research Triangle Park, NC</i>	334,000
4851	Economics of Forest Resources, <i>Research Triangle Park, NC</i>	970,000
4852	Southern Global Change Program, <i>Raleigh, NC</i>	1,376,000
4901	Recreation, Urban Forests, and Human Dimensions, <i>Athens, GA</i>	732,888
4951	Southern Center for Wildland-Urban Interface, <i>Gainesville, GA</i>	244,400
	Total.....	\$44,531,000

Collaborative Research

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Collaborative research and development with universities, private corporations, nongovernmental organizations, and other Federal and State agencies is a cornerstone of the SRS program. These activities involve the funding of extramural studies under cooperative agreements, grants, and interagency agreements. Working with partners is an effective way to leverage our funding to conduct research efforts that benefit a wide range of research results users.

Forest Residue Bundling Fuels Reduction Partnership

The Forest Operations Research unit in Auburn, AL, has been instrumental in a successful partnership to utilize new technology to address the build-up of hazardous forest fuels. “Forest Residue Bundling” is an innovative technology from Scandinavia that may have important applications in addressing forest fuels treatments in the United States. By collecting small-diameter material and forest residues into large, dense bundles the Scandinavian equipment addresses one of the critical issues associated with recovering and utilizing forest biomass—the economical handling and transport of large quantities of small material. Two years ago, the members of the Forest Residue Bundling Evaluation Team identified this technology overseas and began to develop a plan for demonstration and evaluation in fuel reduction

treatments. Since residue bundling technology was so new and innovative, the project was structured to provide both research opportunities and demonstration/technology transfer. The project plan covered seven different sites in the western United States, in order to test the system in different conditions as well as to provide exposure to a wide audience. From the outset the project was a coordinated effort among national forest districts and Forest Service research.

At each demonstration site, the biomass bundling machine was extensively tested with detailed measurements of site disturbance, fuels treatment, and machine productivity and performance. The resulting biomass bundles were transferred to local biomass users to examine utilization opportunities ranging from energy to fish habitat improvement and erosion control structures. Samples from bundles in each location were shipped to the Forest Products Laboratory for analysis. In addition, each location hosted

Biomass bundling technology can reduce fuels buildup on the forest floor.

USDA Forest Service



Collaborative Research

demonstration days for public and agency audiences in accordance with a Technology Transfer Plan.

In order to achieve the goals of this project, grass-roots partnerships were developed with local units, contractors, and other research groups. Local Forest Service districts contributed funding to accomplish treatment implementation. The State and Private Forestry branch contributed funding to support treatments on private lands. The Bureau of Land Management supported treatment on their ownership through contract adjustments with ongoing operations. The Forest Operations Research unit covered funding for additional study requirements including ancillary contracts and technology transfer activities. John Deere/Timberjack coordinated and covered equipment transport, support, and maintenance throughout the project. Procurement work and grants and agreements were coordinated through the Southern Research Station. In addition to the direct funding, all of the partners contributed generously through in-kind support in order to achieve the common goal of evaluating a new tool for treating fuels. The non-Federal in-kind and financial contributors include:

John Deere/Timberjack Forest Products
John Deere Legislative Affairs
Southwest Idaho Resource Advisory Committee
Boundary County Commission, Idaho
Deschutes County Commission, Oregon
Oregon Department of Forestry
Woodland Restoration, Inc.
Johnson Contracting
Ed Hanscom Logging
Biomass One, White City Oregon
Warm Springs Forest Products
Wheelabrator Shasta Energy Company
Boise-Cascade, Medford Oregon
Fodge Pulp, Bonner's Ferry Idaho
Stone Container, Missoula Montana
Robinson Logging, Nevada City, CA

The Forest Residue Bundling Evaluation Project field work was successfully completed between June and September, 2003. Data analysis, research reports, and project record information will be compiled this fall and winter. From a research perspective, the partnership approach enabled evaluation of the bundling equipment across a wide range of stand conditions, species, and terrain. The resulting body of data will provide a robust examination of the potential for using this tool to address fuel treatment needs. The technology transfer portion of the study has been very successful. Each demonstration has been well-attended, with a mix of agency, industry, and general public attendees. These events have been covered by television, radio, and newspaper outlets with positive coverage of the central theme of studying new tools for resource management. The importance of fuels treatment issues and the innovative technology attracted site visits from numerous congressional staff members. There have been follow-up reports of efforts to initiate new biomass utilization and recovery efforts at two of the demonstration sites.

Grants and Agreements

A total of \$15,980,521 supported research studies under grants and other agreements in FY03 with the following:

Domestic non-Federal Agreements

Alabama A&M University
Alabama Forestry Commission
Arkansas Forestry Commission
University of Arkansas
Arkansas Tech University
Auburn University
College of Charleston
Clemson University
Colorado State University
Crossett Water Commission
Tommy R. Dell
Duke University
Florida A&M University

continued



Collaborative Research



Domestic non-Federal Agreements, continued

Florida Department of Agriculture and
Consumer Services
University of Florida
Florida State University
Georgia Forestry Commission
University of Georgia Research Foundation, Inc.
University of Georgia
Gordon Research Conferences
Institute of Forest Biotechnology
Kentucky Division of Forestry
University of Kentucky Research Foundation
Louisiana Department of Agriculture
Louisiana State University
Louisiana Tech University
University of Maryland
Medaille College
University of Memphis
University of Minnesota
Mississippi State University
University of Missouri
National Council for Air & Stream Improvement
Nance Enterprises, Inc.
University of Nevada
University of New Hampshire
State University of New York
North Carolina Department of Environment,
Health, and Natural Resources
North Carolina State University
University of North Carolina at Asheville
Northern Arizona University
Oklahoma State University
Oregon State University
Pacific States Marine Fisheries Commission
Pinchot Institute for Conservation
Rutgers University
Society of Wetland Scientists, Inc.
South Carolina Forestry Commission
Southern Forest Research Partnership
Southern Illinois University
University of Southern Mississippi

Stephen F. Austin State University
Stoney Forensics, Inc.
Tennessee Department of Agriculture
University of Tennessee
Texas A&M Research Foundation
Texas Agricultural Experiment Station
Texas Forest Service
University of Toledo
Tulane University
Utah State University
Virginia Department of Forestry
Virginia Polytechnic Institute & State University
Washington State University
Western Forestry & Conservation Nursery
University of Wisconsin
Yale University

International

A total of \$31,500 supported research studies under grants and cooperative agreements in FY03 with the following:

Heilongjiang University
Research Institute of Forestry
Research Institute of Wood
South China University of Technology
Universitat fur Bodenkultur

Interagency Agreements

A total of \$629,294 supported research studies under interagency agreements in FY03 with the following:

CASU, South Carolina
CASU, Atlanta
USDI, Geological Survey
USDA, Agricultural Research Service
Department of the Army, Corps of Engineers
USDI, Fish and Wildlife
USDA, National Finance Center
Navy Systems Management Activity

Research Work Unit Directory

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SRS-4105, Vegetation Management and Longleaf Pine; and SRS-4703, Forest Operations Research, are located at:

G.W. Andrews Forestry Sciences Laboratory
520 Devall Drive
Auburn, AL 36849
334-826-8700

Web site for SRS-4105:

<http://www.srs.fs.usda.gov/4105/index.html>

Web site for SRS-4703:

<http://www.srs.fs.usda.gov/forestops/>

SRS-4106, Upland Forest Ecosystems, is located at:

Forest Resources Building, Room 114
University of Arkansas at Monticello
P.O. Box 3516, UAM Station
Monticello, AR 71656-3516
870-367-3464

Web site for SRS-4106:

<http://www.srs.fs.usda.gov/4106/>

SRS-4104, Disturbance of Southern Pine Ecosystems; SRS-4505, Insects and Diseases; and SRS-4901, Recreation, Wilderness, and Demographic Trends, are located at:

Forestry Sciences Laboratory
320 Green Street
Athens, GA 30602-2044
706-559-4222

Web site for SRS-4505:

<http://www.srs.fs.fed.su/4505/>

Web site for SRS-4901:

<http://www.srs.fs.usda.gov/trends/>

SRS-4951, Center for Southern Wildland-Urban Interface Research and Information is located at:

408 West University Avenue
Gainesville, FL 32601
404-347-1647

Web site for SRS-4951:

<http://www.interfacesouth.org/>

SRS-4802, Legal, Tax, and Economic Influences, is located at:

701 Loyola Avenue; Rm 10034
New Orleans, LA 70113
504-589-6651

Web site for SRS-4802:

<http://www.srs.fs.usda.gov/4802/>

SRS-4111, Southern Pine Forests, SRS-4501; Bark Beetles and Invasive Insects; and SRS-4701, Southern Forest Resource Utilization, are located at:

Alexandria Forestry Center
2500 Shreveport Highway
Pineville, LA 71360
318-473-7216

Web site for SRS-4111:

<http://www.srs.fs.usda.gov/4111/>

Web site for SRS-4501:

<http://www.srs.fs.usda.gov/4501/>

Web site for SRS-4701:

<http://www.srs.fs.usda.gov/4701/>

SRS-4153, Southern Institute of Forest Genetics, is located at:

Harrison Experimental Forest
23332 Highway 67
Saucier, MS 39564
228-832-2747

SRS-4502, Wood Products Insect Research, is located at:

201 Lincoln Drive
Starkville, MS 39759
662-338-3112

Web site for SRS-4502:

<http://www.srs.fs.usda.gov/termites/>

continued

Research Work Unit Directory

SRS-4155, Center for Bottomland Hardwoods, is located at:

Southern Hardwoods Laboratory
P.O. Box 227
Stoneville, MS 38776-0227
662-686-3178

SRS-4155 Web site:
<http://www.srs.fs.usda.gov/cbhr>

SRS-4101, Southern Appalachian Forests, is located at:

Bent Creek Experimental Forest
1577 Brevard Road
Asheville, NC 28806
828-667-5261

SRS-4101 Web site:
<http://www.srs.fs.usda.gov/bentcreek/>

SRS-4351, Watershed Responses to Disturbance, is located at:

Coweeta Hydrologic Laboratory
3160 Coweeta Lab Road
Otto, NC 28763
828-524-2128

SRS-4351 Web site:
<http://coweeta.ecology.uga.edu/>

SRS-4852, Southern Global Change Program, is located at:

920 Main Campus Drive
Venture Center II, Suite 300
Raleigh, NC 27606
919-515-9489

SRS-4852 Web site: <http://www.sgcp.ncsu.edu/>

SRS-4154 Biological Foundations of Sustainability; SRS-4803, Forest Health Monitoring; and SRS-4851, Economics of Forest Resources, are located at:

Forestry Sciences Laboratory
3041 E. Cornwallis Road
P.O. Box 12254
Research Triangle Park, NC 27709
919-549-4000

SRS-4154 Web site:
<http://www.srs.fs.usda.gov/soils/soilhome.htm>
SRS-4803 Web site:
<http://srs.fs.usda.gov/4803/index.html>
SRS-4851 Web site:
<http://www.srs.fs.usda.gov/econ/>

SRS-4103, Center for Forested Wetlands, is located at:

Center for Forested Wetlands Research
2730 Savannah Highway
Charleston, SC 29414
843-766-0371

SRS-4103 Web site:
<http://www.srs.fs.usda.gov/charleston/>

SRS-4201, Threatened and Endangered Species, is located at:

Department of Forest Resources
Clemson University
Clemson, SC 29634-1003
864-656-3284

SRS-4201 Web site:
<http://www.srs.fs.usda.gov/4201/>

SRS-4801, Forest Inventory and Analysis, is located at:

Southern Research Station
4700 Old Kingston Pike
Knoxville, TN 37919
865-862-2027

SRS-4801 Web site: <http://srsfia2.fs.fed.us/>

SRS-4251, Wildlife Habitat and Timber Resources Integration, is located at:

Wildlife Habitat and Silviculture Laboratory
Box 7600, SFA Station
506 Hayter Street
Nacogdoches, TX 75965
936-569-7981

SRS-4251 Web site:
<http://www.srs.fs.usda.gov/wildlife/index.html>

SRS-4202, Coldwater Streams and Trout Habitat; and SRS-4702, Tree Quality, Processing, and Recycling, are located at:

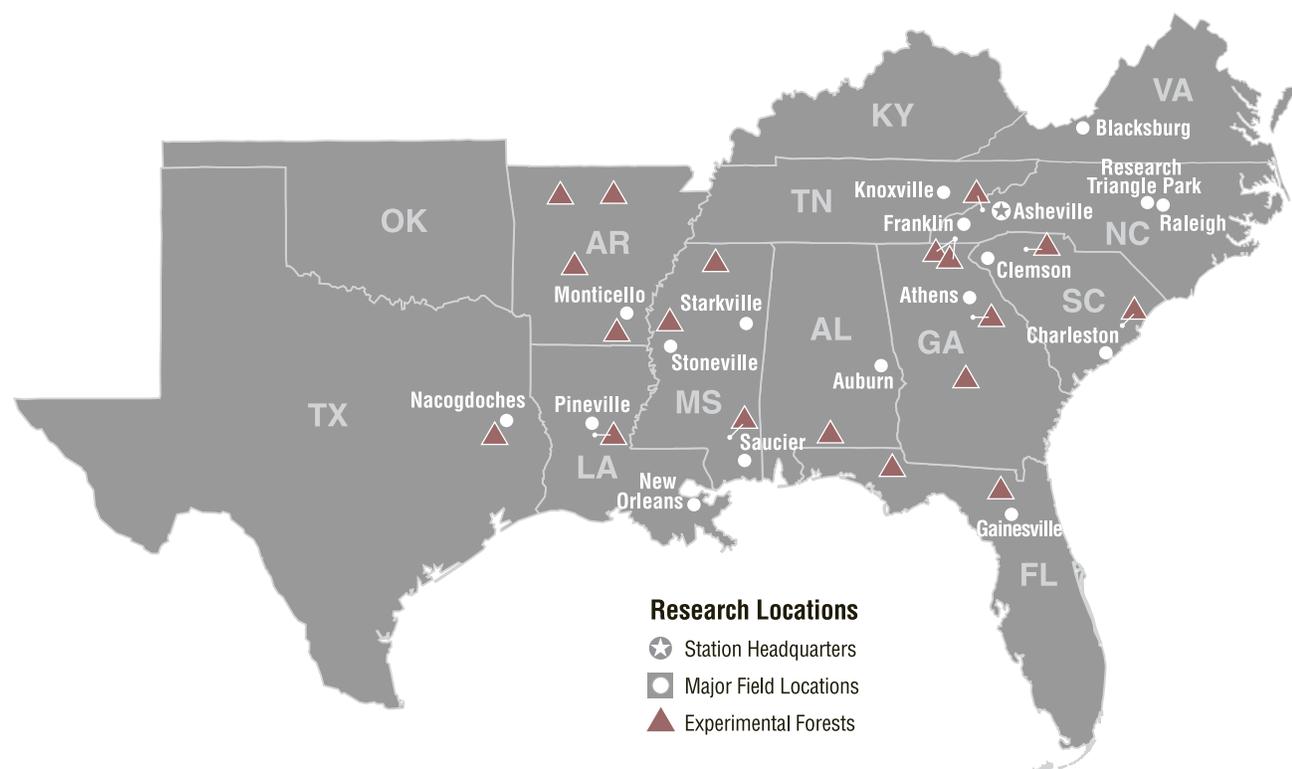
1650 Ramble Road
Blacksburg, VA 24060-0503
540-231-4016

SRS-4202 Web site:
<http://www.trout.forprod.vt.edu/>
SRS-4702 Web site:
<http://www.srs4702.forprod.vt.edu/>

Experimental Forests

The Station maintains 19 experimental forests located on or near National Forest System lands. Scientists use these as sites for their studies and demonstration projects in conjunction with the managing national forest unit. Experimental forests are designated to represent a specific ecosystem or forest type, and to present opportunities for the study of different approaches to sustaining forested ecosystems. Several of the experimental forests in the South were selected for their potential to demonstrate rehabilitation of deteriorated farm forests and soil resources that occurred during early European settlement and plantation farming of the region.

Among the experiments conducted on these forests are studies on stand management and regeneration; restoration of wildlife and plant populations; watershed management; fuels reduction; and the effects of pollution, climate change, and timber harvest. Many experimental forests also provide educational and nonmotorized recreation activities, including interpretation to enhance public understanding of forest management principles. Research on experimental forests plays a vital role in the conservation of America's natural resources.



Experimental Forests

State	Experimental Forest	National Forest	Acres	Date Established
Alabama	Escambia	(private)	3,000	06/14/61
Arkansas	Alum Creek	Ouachita	4,659	04/02/59
	Crossett	Ouachita	1,680	08/27/34
	Henry R. Koen	Ozark	720	09/17/51
	Sylamore	Ozark	4,292	03/28/34
Florida	Chipola	Federal/Leased	2,760	06/21/61
	Olustee	Osceola	3,500	03/28/34
Georgia	Hitchiti	Oconee	4,602	12/04/61
	Scull Shoals	Oconee	4,500	09/17/38
Louisiana	Palustris	Kisatchie	7,515	07/19/35
Mississippi	Delta	(private)	2,600	06/14/61
	Harrison	DeSoto	4,111	07/19/34
	Tallahatchie	Holly Springs	4,569	04/12/50
North Carolina	Bent Creek	Pisgah	5,242	06/25/27
	Blue Valley	Nantahala	1,200	06/23/64
	Coweeta	Nantahala	5,482	03/28/34
South Carolina	John C. Calhoun	Sumter	5,082	10/08/47
	Santee	Francis-Marion	6,000	07/06/37
Texas	Stephen F. Austin	Angelina	2,499	06/28/61

Administration

Civil Rights

The Southern Research Station continues its strong commitment to civil rights and efforts toward recruitment and retention of a highly skilled diverse workforce. Operating with a full-time Civil Rights (CR) Director and a Stationwide CR Committee, SRS works to assure a fully engaged workforce and a trusting work environment. The Station continues its support for recruitment initiatives at Florida and Alabama A&M Universities (FAMU and AAMU), and the conservation education intern program, and partnerships remains strong. A newly-implemented Mentor Program, the Station Director's Awards Program, recurring multicultural events, and funding for employee training and student hires are used to develop and nurture a more diverse and inclusive workforce.

One aspect of SRS research addresses social and economic relationships between forests and people, particularly underserved communities. One ongoing program involves outreach to American Indians interested in native plant production. The initiative has gained national attention and provides a cross-cutting service to assist American Indians with propagation of native plants with environmental, cultural, medicinal, and spiritual value. In FY03 a member of the Navajo Nation was hired as Tribal Nursery Coordinator and assigned to the Southern Pine Forests research work unit in Pineville, LA. The coordinator, located in Moscow, ID, organizes meetings and provides workshops and training sessions to tribes who learn to better grow native plants to aid in land restoration.

USDA Under Secretary for Natural Resources and Environment Mark Rey and Forest Service Chief Dale Bosworth attended a special celebration and symposium at AAMU in honor of the university's success in achieving accreditation status from the Society of American Foresters. AAMU is the first Historically Black College or University to receive this distinction. For more than 10 years SRS has provided unwavering support of the national multicultural recruitment initiative at AAMU. Three university professors and the FS National Initiative Liaison at AAMU published a well-received paper *Enhancing Workforce Diversity in Forestry: A Model of University-Employer Participation*. The paper was included in the annual proceedings for the 2003 Society of American Foresters Convention. In 1992, FAMU and the University of Florida implemented a 2+2 joint degree program in Forestry and Natural Resources Conservation. This program is funded by the national initiatives of the USDA Forest Service. In FY03 history was made when a student in the program was elected president of the University of Florida Student Chapter of the Society of American Foresters — the first African-American to be elected chapter president at the University.

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Awards

Rebecca Allen and **J.C. Smith** received the Chief's Award for Volunteer of the Year for exemplary service in advancing the Forest Service mission by effectively recruiting and utilizing retired, student, and international volunteers. ▲

Administration

SCSEP Program

The Southern Research Station had another successful year with its Senior Community Service Employment Program (SCSEP), during Program Year 2002-2003. Increased emphasis was placed on accomplishing all SCSEP targets; however, the unsubsidized placement target carried the heaviest weight with the Department of Labor. All of the

SCSEP National Sponsors were held accountable for placing at least 37 percent of their SCSEP enrollees into unsubsidized jobs during the Program Year.

The 2002-2003 SCSEP accomplishments for the Southern Research Station were as follows:

Enrollees	Females	Minorities	Enrollee hours	Placement goal	Participation rate
Goal: 57	Goal: 27	Goal: 19	Goal: 58,710	Goal: 23	Goal: 80
Accomplished: 55.75	Accomplished: 24.50	Accomplished: 21.25	Accomplished: 58,902.25	Accomplished: 34	Accomplished: 102
Percentage Accomplished: 97.81%	Percentage Accomplished: 90.74%	Percentage Accomplished: 111.84%	Percentage Accomplished: 100.33%	Percentage Accomplished: 147.83%	Percentage Accomplished: 121.25%

The Columbia Shuttle Recovery Effort

When the space shuttle Columbia broke apart scattering into thousands of pieces across an area from Dallas, TX to Leesville, LA, Forest Service employees, including many from the Southern Research Station, became an important part of the recovery effort. The Forest Service employees became a part of a truly National team effort with many Federal and State agencies working together. SRS personnel from many units provided surveying expertise and GPS technology to pinpoint locations of debris and many others worked providing leadership to ground crews of volunteers and local fire and law enforcement personnel who searched for debris.

After several months of the recovery effort, about 40 percent of the spacecraft was retrieved—nearly 80,000 pieces. At an “Appreciation Event” hosted by NASA and FEMA in Lufkin, TX for all those who helped in the recovery, NASA Administrator Sean O’Keefe presented the Station with a beautiful framed print that reflected the spacecraft and recovery effort. Both NASA and FEMA were humbled by the dedication of the people involved in the search and recovery.



Paul Jackson with astronaut Janice Voss. The banner behind them is for individuals working in the recovery to sign.

The success of the effort was critical to NASA returning to space flight. The Station employees made a significant contribution to the recovery effort and those who were involved will have lasting memories of the sacrifice of the shuttle crew and the commitment of the recovery teams in helping determine the cause of the accident.



Administration

SRS Competitive Sourcing Study

An express study of the SRS facility, grounds, and fleet maintenance activities performed at six geographically dispersed duty locations, involving 5.5 full time equivalent employees, was conducted in accordance with OMB Circular No. A-76 (Revised) May 29, 2003. The decision was made to retain performance in house, using the existing organization to continue to perform the work under current performance provisions. Cost comparisons revealed that at our Station and unit locations, the work can be performed at a lower cost by the Government.

The facility and grounds maintenance study included all buildings, heating and cooling systems, water and wastewater systems, signage, security and fire alarm systems, utilities, grounds, and landscaping. Maintenance tasks that involve operating equipment, use of tools, and/or actual labor accomplishing work were included. This work is being performed by a total of 5.5 full time equivalent employees at SRS Headquarters, Coweeta, Athens, Charleston, Research Triangle Park, and Crossett EF.

Fleet maintenance included the following essential elements necessary to support light vehicles, heavy equipment and project equipment: availability to customers; inspection and field preparation of new vehicles; identification and attention to warranty repairs, recalls and Technical Service Bulletins; preventative maintenance; scheduled and unscheduled maintenance and repair; maintenance of agency-owned or leased shop facilities in compliance with Federal and State safety and environmental regulatory guidelines; facilitation of subcontract repairs; and asset sale preparation.

Acquisition and Property Management

The Southern Research Station/Eastern Administrative Zone Acquisition and Property Management Group was selected by Region 8 for the annual award, "*High Achievement in Meeting National or Regional Goals and Objectives.*" The

selection was based on accomplishments that included exceeding all small business preference goals and exceeding or demonstrating substantial improvement in FS Acquisition Management special emphasis areas.

Streamlined systems and processes

- Transitioned contracting operations to FedBizOpps, the "egov" electronic market and publication venue. Impact: Improved efficiency and competition in the market place by automating the public announcements of contract solicitation and award processes.
- Accomplished baseline training for competitive sourcing and employee orientation to the A-76 process enabling and enhancing the Agency's position for future competitions.
- Group and customer communication initiatives: Team Room and Web site planning. Impact: Automated internal and external customer access to acquisition information.
- Issued 3 limited contracting officer warrants to Support Services Supervisors at Research Work Units and Ranger Districts. Impact: Delegated authority for lower risk, lower dollar purchases substantially increasing responsiveness to customer needs at the field unit and Station Headquarters levels of the SRS.
- Awarded contracts using Commercial Item Procedures. Impact: Supported Federal and Agency acquisition streamlining initiatives and competition by soliciting projects via commercially available processes where practicable. Reduced contracting lead time and overall administration man-hours / costs.
- Transitioned computer ordering processes to automated computer-ordering system. Impact: Supported automation of computer ordering processes yielding program efficiencies and decreasing the acquisition lead time for requirements.

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Workforce management

- Supported Federal and agency workforce development goals by hosting 2 contracting trainee positions. Impact: Addressed increasing needs for succession planning and increasing demand for top quality candidates in the acquisition workforce.
- Examined and planned training and staff development initiatives for the SRS Contracting workforce. Impact: Ensured that continuing education requirements were met. Supported developmental opportunities for 100% of Purchasing Agents in the EAZ.

Customer service

- Created the first “hands on” Performance Based Service Contracting” (PBSC) workshop venue for the FS. Impact: Supported Federal government, USDA and FS goals to improve contractor selection, quality and oversight of contracted effort through support of PBSC implementation initiatives. Supported customers by providing training and allowing them to leave the workshop with a finished Performance Work Statement product that was ready to be submitted for procurement.
- Designed and created AQM Team Room and Web site. Impact: Automated internal and external customer access to acquisition status and training information.
- Planned and executed the Competitive Sourcing (CS) express study for maintenance functions at the SRS.

Financial accountability

- Revised the Internal Process Control Plan for the Eastern Administrative Zone to reflect compatibility and joint quality and service initiatives for both the Southern Region and the Southern Research Station. Impact: plan will be the primary vehicle to ensure compliance with mandatory Federal, USDA, and FS requirements and will improve internal controls across the requirements “spend chain.”

- Developed and implemented processes in support of numerous new B&F reporting requirements as a result of the ongoing Agency financial audits. Requirements included: Accrual Accounting Reporting – retrieving accrual estimates from all contractors; monthly and quarterly “cookbook” verifications of all open purchase and contract obligations; commitment reporting for new requirements estimated to exceed \$100,000 in magnitude. Impacts: Provided full and immediate responses to all of the new reported requirements levied via a series of the current FY’s Chief Financial Officer Bulletins. Provided substantial contributions to the Agency’s efforts to achieve a second year’s clean financial opinion.
- Provided full and immediate responses to multiple and ongoing audit processes, including numerous short turn-around requests for audit samples. Impact: This was a high visibility work item for the Agency. However, it was a very high impact item on the group as the sheer volume of original and repeat requests for contract and property documentation was massive. Provided substantial contributions to the Agency’s efforts to achieve a second consecutive year’s clean financial opinion.
- Provided Functional Assistance Visits to Ranger Districts including assessments of compliance with acquisition processes, e.g. purchase card and check writing, and providing “hands on” training and consultation to administrative support personnel at the Districts.
- Achieved reductions in the numbers of SRS purchase cardholders and convenience check writers. Impact: supported FS goals in compliance with financial audit recommendations and USDA mandates.
- Accomplished Real Property Physical Inventory goals for both the SRS and NFsNC. Impact: Supported the ongoing real property physical inventory and condition assessment requirements. Supported the requirements for WO provided real property inventory training on a short notice, short response basis.

Administration

Conservation Education Outreach Program

Once again the Conservation Education Outreach Program (CEOP) continues to be an integral part of the overall education effort of the Station. The concept of the CEOP is to engage youngsters in conservation education activities in urban settings in the inner cities where they live. The target audiences are selected for cultural, sociological, and economic diversity specifically including underserved, nontraditional publics. The goals of the program are: (1) to interact with urban youth from diverse age groups, socioeconomic backgrounds, ethnicities, and geographic locations helping them gain an appreciation for natural resources conservation and sustainability; (2) to create an interest in Forest Service careers among underrepresented

populations in urban environments; and (3) to provide contact between scientists and the summer interns to encourage them to pursue advanced degrees, thereby expanding the pool of diverse candidates for research positions.

Two teams of 4 interns were employed by the Station, one located in Tallahassee, FL and the other in Huntsville, AL. They worked with youngsters from preschool through high school, at locations throughout the South. They did a variety of teaching activities with groups from 30 to 200 youngsters at each site visit, reaching over 3,000 youngsters during the summer of FY03. Additional teams trained in Asheville worked out of Milwaukee and Atlanta.



Branching Out to the Youth of America conservation education interns teach youth the importance of conservation through educational activities.

Administration

Southern Forestry Leadership Tour

The 2003 Southern Forestry Leadership Tour was held April 21–23 at the University of Georgia in Athens (UGA) and hosted by Dr. Jim Sweeney of the UGA College of Forest Resources. The tour brought together university, industry, State, and Federal partners to explore southern forestry issues. The group spent the second day of the tour on the Oconee Ranger District, visiting sites that demonstrated a variety of management issues—a suburban firebreak, a research project on loblolly and longleaf interplanting, a site showing red-cockaded woodpecker management alternatives, and the problem of the hemlock woolly adelgid. The final stop was with a private landowner who had decided to implement an active management plan to improve both wildlife diversity and the health of the property’s forest stands. Participants focused their meeting time on the need to develop common research agendas towards meeting the complex challenges of managing natural resources in an area of rapid population growth and urban/suburban expansion.

Southern Appalachian Healthy Forests Legislative Tour

On August 22, 2003, SRS researchers and legislative staffers toured the French Broad River area above Hot Springs, NC to learn about the challenges that forest managers face in the Southern Appalachian region. The group rafted the French Broad River, stopping at midpoint for lunch and presentations by researchers. From these talks and conversations in the rafts, staff members learned about invasive species, water and air quality, the impact of forest fires, and the problems facing gateway communities.

The damage caused by nonnative invasive plant species such as Nepalese brown top and Japanese knotweed was clearly visible along the banks of the relatively remote river stretch, as was damage from southern pine beetle and a fire from several years before. Researchers talked about the hydrology of the area, the role of the forest in ensuring water quality, and the problems of nonsource pollution from the agricultural and grazing fields that the group floated by. Speakers also emphasized the rapid growth in an area that,

from the view of the river, seemed relatively untouched. The South’s population is expected to grow 24 percent in the next two decades. Many of the people moving into the Southern Appalachians want to build their houses in or near forests, increasing the pressure on air and water quality and further fragmenting the ecology of the area.

PMIs in the Forest Service: A New Breed of Leadership

The Presidential Management Intern (PMI) Program was created in 1977 by Executive Order 12008 to “attract to the Federal service outstanding individuals from a wide variety of academic disciplines, who have an interest in, and commitment to, a career in the analysis and management of public policies and programs. By drawing graduate students from diverse social and cultural backgrounds, the PMI Program provides a continuing source of trained men and women to meet the future challenges of public service.” As part of the 2-year PMI program, interns are required to complete 80 hours of training per year, and are highly encouraged to complete several extended rotations (1 to 4 months) in various sectors of the agency or other related agencies. Government wide, there are up to 400 PMIs selected each year, often out of a pool of up to 5000 applicants. The Forest Service (FS) has been actively taking advantage of these highly skilled and motivated individuals. Investment in the Presidential Management Intern program has significantly increased in the past four years. Since 2000, the agency has hired over 20 PMIs in various positions and departments in field offices and Washington, DC.

The Station has hosted two PMIs in the last year. Between March and May, the first Intern came to the Station on rotation from the Washington Office to work on the Lower Mississippi Alluvial Valley (LMAV) Conservation Project. The white paper that resulted from this project has been peer reviewed and is nearing publication. The first PMI student recently completed her internship and converted to a permanent position on the Mt. Hood National Forest working as a natural resource planner. The second PMI arrived June, 2003 to work with the

Administration

Station's Assistant Director for Planning and Applications on several large-scale projects, including the Southern Roundtable on Sustainable Forests, congressional visits, the LMAV project, and budget analysis.

With growing retirement challenges facing most government agencies, the PMI program is one way to train and prepare the leaders of tomorrow while the leaders of today are still in office. The FS is taking advantage of this opportunity and is seeing increased interest in placement in the field and regional offices of PMIs at the completion of their internships.

Information Distribution

The SRS Web presence (www.srs.fs.usda.gov) grows in strength continuously and features special sections designed to assist users from forest landowners to Members of Congress. As the Internet reaches out into more rural areas, ever-increasing access for previously underserved constituents should result. Web site "hits" now number over 4 million for FY03. Although more than a million hits this fiscal year were due to the Southern Forest Resource Assessment, each year shows a substantial increase in SRS Web site visitation. Approximately 10 to 15 percent of the Web site users are from foreign countries.

The SRS database delivery of Forest Service research publications via the Internet began in 1999 to better organize and distribute a rapidly growing wealth of data. Since that time the project has undergone several revisions and enhancements to become the standard for online delivery of publications. The public has benefited by our development of a fast, effective mechanism for delivery of research products. The database currently receives 2,000 to 3,000 requests per day and is fully indexed by major search engines so that advertising of these products is ubiquitous. Last spring the SRS database was expanded to include records from the other stations or laboratories of origin. Working closely with other Forest Service Research and Development communications offices, in FY03 the database dramatically increased to over 5,000 records with links to full text publications. Through the SRS Web site, over 1,600,000 publication requests have been filled.

Publication Requests Filled

Fiscal Year	Hard Copy	Electronic Downloads
1998	70,000	25,000
1999	33,500	151,000
2000	22,000	200,000
2001	21,000	500,000
2002	26,700	1,000,000
2003	54,600	1,600,000

The Station manages Web sites for six separate domains: USDA Forest Service Southern Region, Urban Forestry South, USDA Forest Service Strategic Plan, The Natural Inquirer, Green America, and Shining Rock Wilderness. The Station also has more than a dozen special project Web sites: Model for National Publications Database of Forest Service research; Southern Forest Resource Assessment; Conservation Education; Congressional Corner for Southern Forest Research; National Multicultural Recruitment Initiative at Alabama A&M University; Smoke Management Project, Fire and Fire Surrogate Studies in Myakka River State Park-Florida, Southeastern Piedmont, and Solon Dixon; Sustainable Forest Management for Brazil; Gila National Forest Dynamic Recreation Map Site; Electronic Customer Comment Cards; and various sites for special events and conferences.

The Station continues to provide hard copy publications by mail for people who prefer to receive them that way or who do not have Internet access. The *Compass*, the SRS quarterly catalog, describes current research publications which are available hard copy or electronically. It also includes information about the Station and its personnel, and a theme focus on some of the recent publications, as well as the current abstracts that have always been its primary content. Approximately 54,600 publications were mailed out in FY03. ▲





Please contact us anytime you have questions or comments about the services of the Southern Research Station.

To receive our quarterly catalog of recent publications, the *Compass*, send us your name and address and we will be happy to add you to our mailing list. The catalog is also on our Web site and you can subscribe to a listserv to receive it by e-mail.

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Caring for the Land and Serving People

Spine